Willamette Basin
Bi-Annual Status Report
February 28, 2022

Table of Contents

List of Figures

List of Tables

Introduction

On September 1, 2021, the U.S. District Court for the District of Oregon issued an interim injunction order that directs the U.S. Army Corps of Engineers ("Corps") and the National Marine Fisheries Service (NMFS) to implement specified actions intended to improve conditions for fish passage and water quality in the Willamette Valley Project (WVP) to avoid irreparable harm to Endangered Species Act (ESA) - listed salmonids during the interim period until the completion of the reinitiated ESA consultation on the operation and maintenance of the WVP. These actions include operational measures; structural improvements; outplanting of adult Chinook salmon above Green Peter Dam; research, monitoring, and evaluation (RM&E); compliance with maintenance outage schedules and emergency protocols; and reporting requirements. The injunction will remain in effect until issuance of a new Biological Opinion (BiOp), which is due no later than December 31, 2024. The injunction requires the Corps and NMFS to provide status reports every six months, beginning February 28, 2022, detailing their progress and compliance with the injunction actions. This is the first Bi-Annual Report and includes accomplishments and data collected from September 01 through December 31, 2021.

Purpose

The purpose of this report is to provide a bi-annual update to the Court that details the Corps' and NMFS's progress and compliance with the injunction actions, including the following information:

1. The injunction measures that have occurred at each dam;
2. Any deviation from outage schedules, emergency protocols, and water quality standards;
3. All RM&E that was conducted during the prior six months and any available results of that research;
4. All RM&E planned for the next six months; and
5. Any proposed changes to the injunction measures based on changed circumstances or the results of RM&E.

Establishment of the Expert Panel

In the injunction, the Court ordered the establishment of an Expert Panel, comprised of two of Plaintiffs' experts, two National Marine Fisheries Service (NMFS) biologists, two Corps employees, and two "ad hoc" Federal experts. This panel is charged with jointly developing specific parameters of certain interim measures ordered in the injunction. The Expert Panel's proposed measures must be in accordance with the best available science, technically feasible, incorporate principles of adaptive management, and provide meaningful RM&E. As of December 31, 2021, the Expert Panel developed and submitted 9 out of 15 plans. These include:

Table 1. List of Completed Injunction Measure Implementation Plans

Injunction Measure	Injunction No.	Date Submitted to the Court	Status
Foster Fall Downstream Fish Passage	13a	August 20, 2021	Implemented in 2021

Cougar Fall Drawdown for Downstream Fish Passage	14	August 20, 2021	Implemented in 2021
Detroit Lower Regulating Outlet (LROs) Operation for Downstream Water Temperature Management	10a/Interim Measure 7	September 08, 2021	Implemented in 2021
Foster Spring Downstream Fish Passage	13b	October 15, 2021	Implementation is ongoing as of February 28, 2022
Cougar Spring Downstream Fish Passage (Delayed Refill)	15a	October 15, 2021	Implementation is ongoing as of February 28, 2022
Fall Creek Winter/Spring Downstream Fish Passage	20	October 15, 2021	Implementation is ongoing as of February 28, 2022
Green Peter Outplanting Plan	11	November 5, 2021	In planning stages
Green Peter Spring Downstream Fish Passage	12a	November 5, 2021	Planned for implemented in mid-March 2022
Lookout Point/Dexter Spring Downstream Fish Passage and Regulating Outlet Use for Downstream Water Temperature Management	17	December 8, 2021	Planned for implemented in mid-March 2022

In addition to the injunction measures listed above, four interim measures, developed prior to issuance of the injunction, were carried forward into the injunction. The Court also ordered the Corps conduct the annual Fall Creek Reservoir deep drawdown operation similar to prior years but extend the dates from December 1 through January 15. These actions did not require Expert Panel development. They include:

Table 2. List of Interim Measures, Adopted as Part of the Injunction Order

Injunction Measure	Injunction No.	Date Submitted to the Court	Status
Detroit Winter Downstream Fish Passage	10/Interim Measure 5	n/a	Implementation is ongoing as of February 28, 2022
Big Cliff TDG Abatement	10/Interim Measure 6	n/a	Implementation is ongoing as of February 28, 2022

Detroit Spring Downstream Fish Passage and Summer/Fall Downstream Water Temperature Management	10a/Interim Measure 7	n/a	Planned for implementation in mid-March 2022
Hills Creek Winter Downstream Fish Passage	8	n/a	Implementation is ongoing as of February 28, 2022
Fall Creek Extended Deep Drawdown	19	n/a	Implemented in 2021

In 2021, seven injunction measures were implemented, while the remaining measures will be implemented in 2022 or beyond. The measures that were implemented in 2021 are discussed in detail in the Operational Measures section below.

The Corps has developed a publicly-accessible website that include details regarding injunction measure implementation plans that have been finalized, along with any associated RM&E data collected during implementation. The link is: https://www.nwp.usace.army.mil/Locations/Willamette-Valley/Injunction/

Research, Monitoring and Evaluation

The injunction requires the Corps to continue to fund and/or carry out RM&E to evaluate the effects of the interim injunction measures on Upper Willamette River (UWR) spring Chinook salmon and UWR winter steelhead.

In developing implementation plans for operational measures, the Expert Panel proposed specific RM&E to accompany the injunction measures in the short term until a long-term RM&E plan could be developed. The Expert Panel submitted the Willamette Project Interim Injunction Measures RM&E Plan to the court on February 18, 2022. This plan supersedes the measure-specific RM&E that was included in the implementation plans submitted by the Expert Panel to date. This RM&E plan will be in effect for the duration of the injunction, anticipated to extend through 2024.

RM&E that was conducted for injunction measures implemented through December 31, 2021 is discussed by measure in the Operational Measures section below. Detailed results of the RM&E will be made available on the Corps' Willamette Valley Injunction webpage at https://www.nwp.usace.army.mil/Locations/Willamette-Valley/Injunction/.

RM&E that is planned for injunction measures that will be implemented over the next six months is also identified by measure in the Operational Measures section below.

Operational Measures

The injunction requires the Corps to implement the injunction measures "to the greatest extent

practicable under existing hydrologic conditions and necessary flood control operations" while making "every effort to comply with the various water quality standards governing the WVP." The Corps implemented all of the operational measures ordered to occur during the period of September 1, 2021 – December 31, 2021 on time. All measures are discussed in detail below.

North Santiam River Injunction Measures

The North Santiam subbasin drains about 760 square miles. Detroit and Big Cliff dams are two of the 13 multi-purpose projects operated by the Corps in the Willamette Valley in Oregon. Located in Marion County in the rugged mountain forests below Mt. Jefferson, the two dams store the waters of the North Santiam River. The construction of Detroit and Big Cliff dams was completed in 1953 and formed a complete barrier to upstream fish passage; downstream passage is also inhibited. Currently, the North Santiam is inhabited by ESA-listed UWR winter steelhead and spring Chinook salmon.

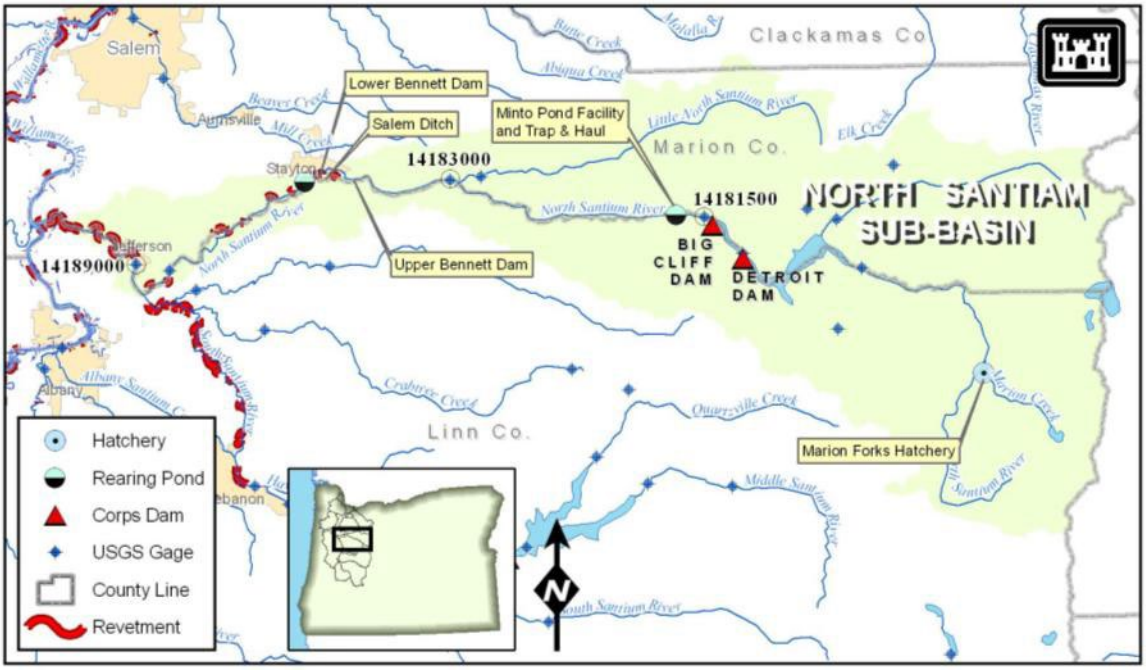


Figure 1. Detroit and Big Cliff Dams, North Santiam River

Injunction Measure 10 requires the Corps to carry out fish passage and water quality operations at Detroit and Big Cliff reservoirs as detailed in the Corps' Interim Measures Nos. 5-7, as modified in the Proposed Revision to Interim Measure 5 and Injunction Measure 10a (modifying Interim Measure 7), both adopted by the Court in an order dated September 21, 2021.

Detroit Fall/Winter Downstream Fish Passage (Injunction Measure 10/Interim Measure 5)

Description: In an effort to improve downstream fish passage and survival, a fall/winter downstream

passage operation was implemented in 2021. This measure consisted of prioritizing flow releases through a non-turbine outlet during the fall/winter once the Detroit Reservoir elevation was less than 100 feet over the turbine intakes (El. 1450 -1500 ft.). The turbines were operated at Detroit Dam during the day (unless otherwise dictated by downstream water temperature conditions), while a non-turbine outlet was prioritized to pass flow at night (from dusk until dawn), with no turbine operation (no power generation) during this period (except for Station Service[1] if needed for emergencies or for downstream TDG management). As originally written, this measure was in direct conflict with the Detroit lower regulating outlet (LRO) downstream water temperature management measure (Injunction Measure 10a/Interim Measure 7, details below) because the former specified that flows be passed through the upper regulating outlet (URO) when not passed through the turbines. The Corps proposed a revision to Interim Measure 5 requiring the use of a "non-turbine outlet" at night for downstream fish passage rather than the "upper regulating outlet" (URO) specifically to accommodate LRO use as provided by Injunction Measure 10a/Interim Measure 7. The Court adopted this revision in its order dated September 21, 2021.

Implementation:

The Detroit reservoir reached 1500 ft. elevation on September 27, 2021 (Figure 2). The URO was already in use for downstream water temperature management and this operation continued throughout the fall. On October 13, flow transitioned to the LRO (only) for downstream water temperature management, and as agreed by the Expert Panel, temperature management was given priority over downstream fish passage during this time (and while temperature management was necessary). While the LROs were in operation, fish likely did not sound and pass through the 200 feet deep set of LROs. Furthermore, fish likely did not pass through the turbines. Therefore, biologically speaking, while the LROs were not likely to provide downstream fish passage, the operation can still be considered a protective measure for fish passage survival while simultaneously providing a benefit to downstream water temperatures.

Once water temperature management operations concluded (on November 5, 2021), the operations shifted back to nighttime UROs with turbines at station service levels (Table 3). This operation will continue until Detroit Reservoir is refilled above El. 1500 ft. in the spring (2022).

[1] Station Service outflow varies by elevation, but averages ~300 cfs when the reservoir is at or near minimum conservation pool elevations.

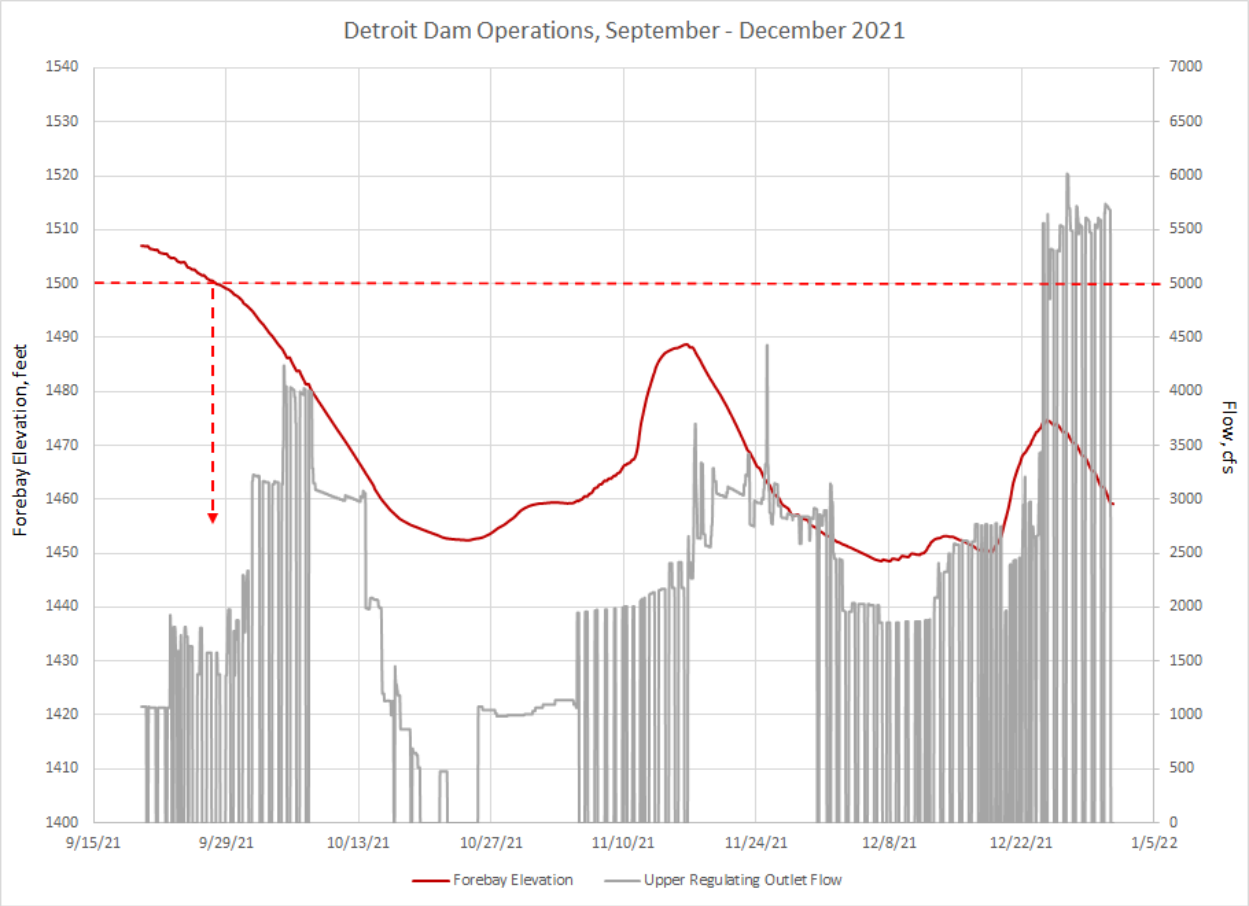


Figure 2. Detroit Dam Operations during Implementation of Injunction Measure 10

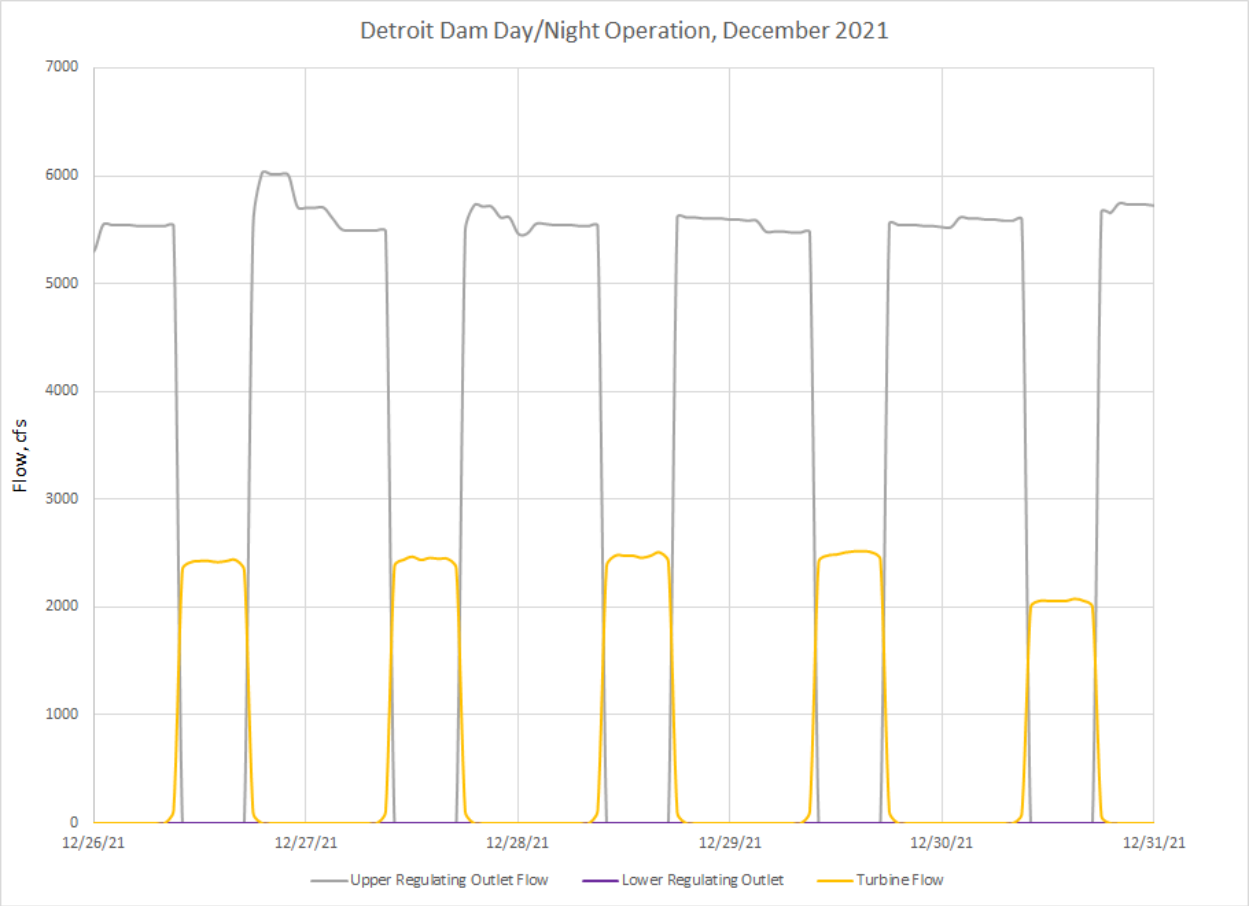


Figure 3. Detroit Dam Nighttime RO/Daytime Generation Operation (Zoomed In)

RM&E: The Corps operated an 8 ft. diameter rotary screw trap (RST) below Big Cliff Dam during implementation of this measure to monitor downstream juvenile Chinook salmon passage timing through the Detroit / Big Cliff dam complex (Figure 4). Juveniles are expected to migrate from Detroit Dam through Big Cliff in less than one day and will have used turbines or spillway for passage past this dam. This RST will continue sampling through February 15, 2022 and will begin sampling again March 15, 2022 to monitor the injunction measures associated with passage at Detroit and Big Cliff dams. Further monitoring will be conducted as described in the Willamette Project Interim Injunction Measures RM&E Plan.

RST sampling captured juvenile Chinook throughout the evaluation period with low relative capture rates (Figures 5-9), consistent with historical outmigration trends past Detroit and Big Cliff as anticipated for this time period. Please note that data contained herein is subject to revision as this data is preliminary and undergoing QA/QC procedures. Future reports will compare RST fish data for the injunction operations to previous operations.

Approximately 1,000 juvenile spring Chinook were released above Detroit Dam on November 10, 2021 to evaluate passage; each fish was marked with an adipose fin clip and caudal fin clip. As of February 2022, none of these fish have been recaptured in the rotary screw trap below Big Cliff Dam.

When fish are available, juvenile salmon caught in the trap will be held (during lower RO operation) to directly assess delayed mortality (aim for 30–50 fish per week). Fish for the test should be held as close to the trap as possible (e.g., portable tanks near Detroit or Big Cliff dams); or at Minto fish collection facility, but in a location not subject to high levels of TDG. Mortality will be monitored and recorded for 24 hours. Due to the logistics associated with implementing this evaluation at Big Cliff Dam where no infrastructure exists for holding fish (e.g., water supplies, tanks), this monitoring did not occur in 2021, but is planned for March 2022 and beyond as described in the Willamette Project Interim Injunction Measures RM&E Plan.

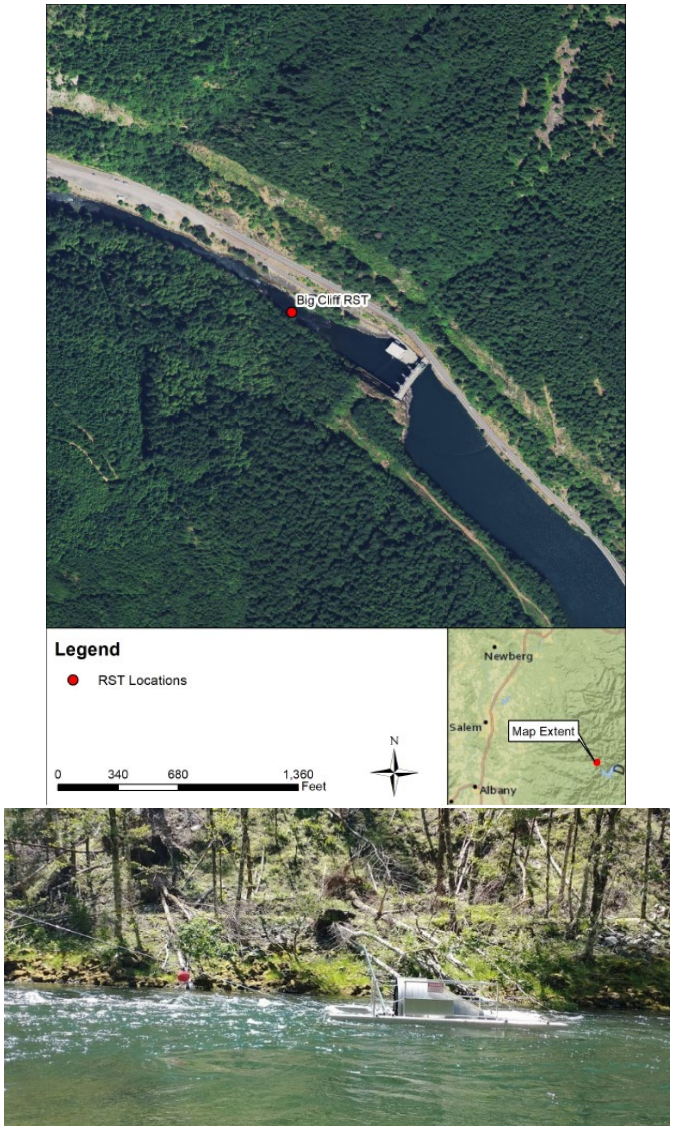


Figure 4. Rotary Screw Trap sampling location below Big Cliff Dam.

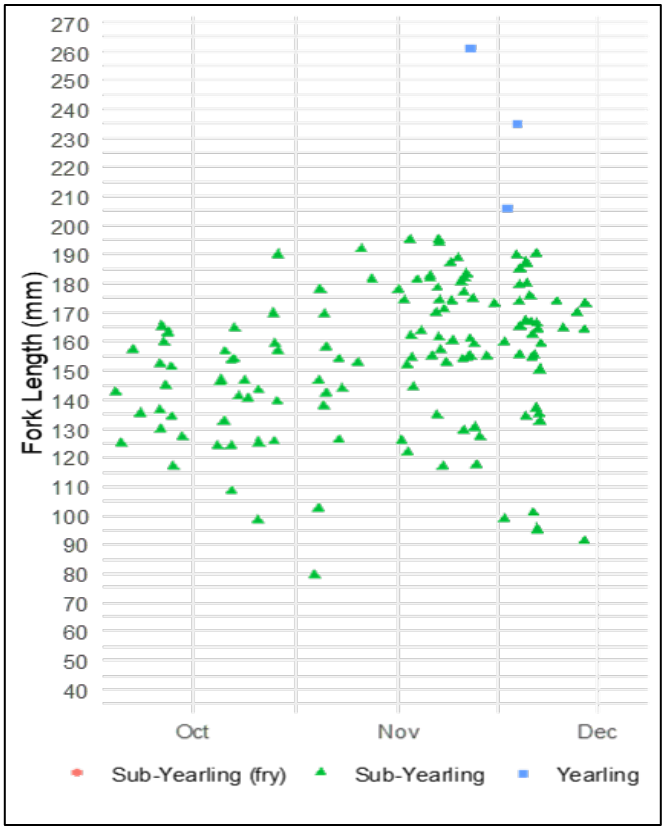


Figure 5. Fork lengths and capture dates of juvenile Chinook salmon captured in the rotary screw trap below Big Cliff Dam during the late September to 30 November 2021 period. These results represent direct capture of juvenile spring Chinook and have not been adjusted for rotary screw trap capture efficiency or sampling effort. Sampling results from 30 November 2021 – 15 February 2022 will be presented in future reports. Blue squares represent yearlings, green triangles represent sub-yearlings and red points represent fry. Please note that data contained herein is subject to revision as this data is preliminary and undergoing QA/QC procedures.

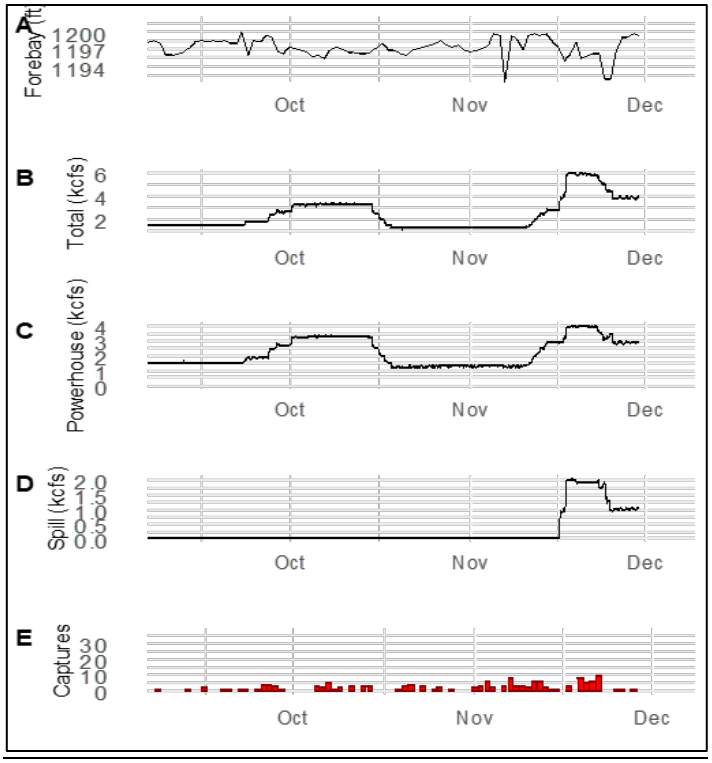


Figure 6. An 8ft diameter rotary screw trap was operated below Big Cliff Dam during implementation of Injunction Measure 10. Data in this figure is for the late September to November30th, 2021 period. Panels display Big Cliff Dam forebay elevation (panel A), total outflow (panel B), powerhouse flow (panel C), spill via spillway gates (panel D), captured Chinook salmon (panel E), and trapping effort (panel F). Trapping effort is calculated as trap revolutions divided by the number of minutes elapsed since the trap was last checked. Please note that data contained herein is subject to revision as this data is preliminary and undergoing QA/QC procedures.

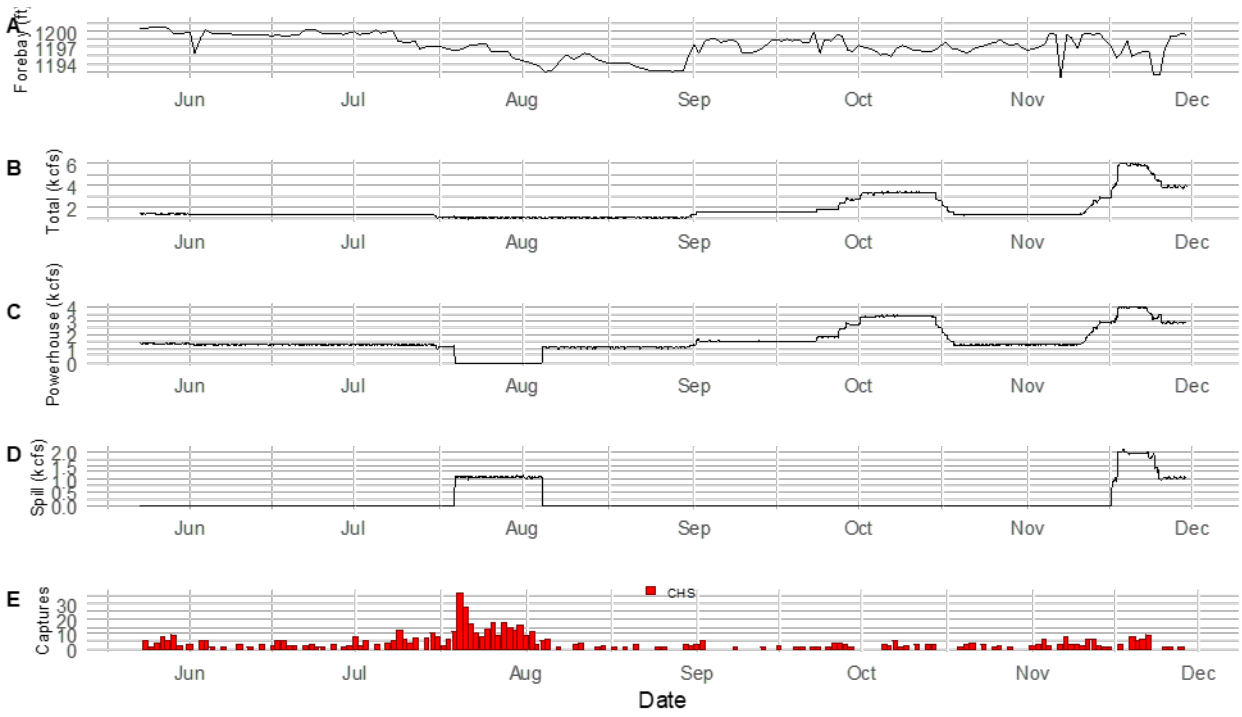


Figure 7. An 8ft diameter rotary screw trap was operated below Big Cliff Dam during implementation of Injunction Measure 10. Data in this figure is for the late September to Nov 30th, 2021 period; data for the sampling periods beyond 30 November 2021 will be reported in future reports. Panels display Detroit Dam forebay elevation (panel A), total outflow (panel B), powerhouse flow (panel C), and spill (spillway and Regulating Outlets combined) (panel D) plus juvenile Chinook salmon captured below Big Cliff Dam (panel E). These results represent direct capture of juvenile spring Chinook and have not been adjusted for rotary screw trap capture efficiency or sampling effort. Please note that data contained herein is subject to revision as this data is preliminary and undergoing QA/QC procedures.

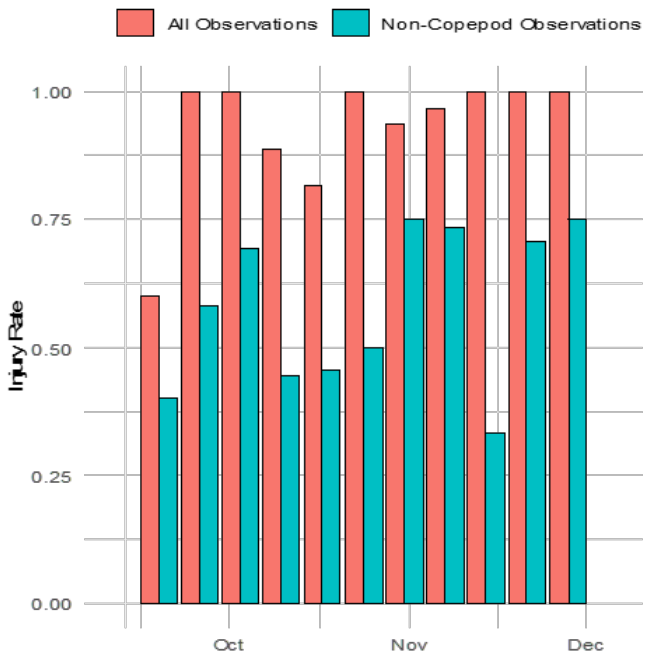


Figure 8. Weekly injury rates observed in juvenile Chinook salmon captured below Big Cliff Dam, mid-September through Nov 30, 2021; data for the sampling periods beyond 30 November 2021 will be reported in future reports. Red bars depict the injury rate with the presence of copepods counting as an injury. Blue bars depict the injury rate not including copepods. Injury assessments include observations of bloated, bruising, bleeding, copepods (present on gills and/or fins), descaling less than 20%, descaling more than 20%, bloody eye (hemorrhage), fin damage, fungus, fin blood vessels broken, gas bubble disease, hole behind anal fin, hole behind pectoral fin, hole behind ventral fin, head injury, mortality, opercula damage, pop eye – exophthalmia, predation (claw or teeth marks), and body injury (tears, scrapes, etc.). Please note that data contained herein is subject to revision as this data is preliminary and undergoing QA/QC procedures.

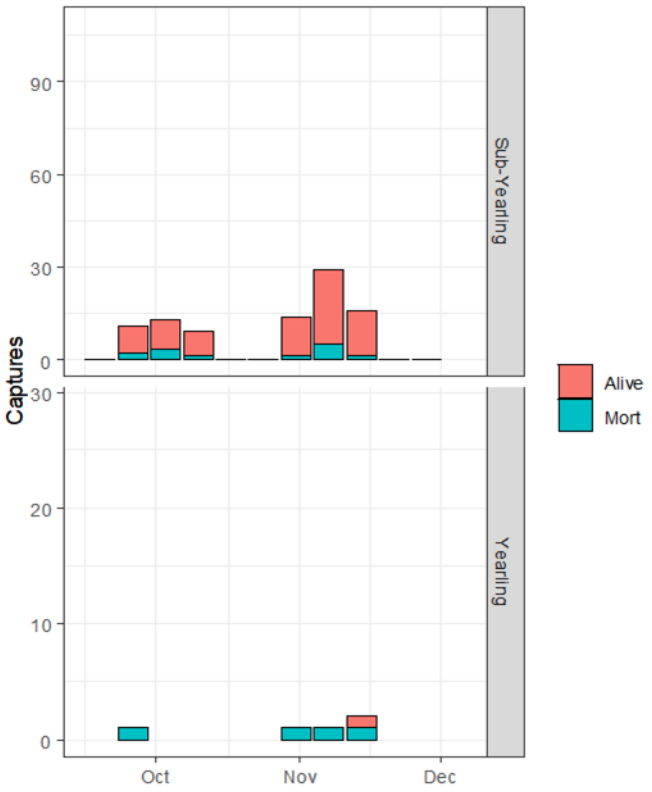


Figure 9. The number of juvenile Chinook salmon captured below Big Cliff Dam that were alive (red) or dead (blue) by age class (sub-yearling vs. yearling), for the period of mid-September to 30 November 2021; data for the sampling periods beyond 30 November 2021 will be reported in future reports. Please note that data contained herein is subject to revision as this data is preliminary and undergoing QA/QC procedures.

Lessons Learned/Future Year Recommendations: The upper and lower ROs at Detroit Dam are known to produce elevated levels of TDG downstream of the dam. One challenge during implementation of this measure was balancing the RO operations with downstream TDG.

During implementation of this measure and Injunction Measure 10/Interim Measure 7 (details below), holding downstream TDG levels below the State water quality standard of 110% TDG saturation while trying to comply with, and maximize the benefits of, the injunction measure posed some difficulties, and this was communicated with both the regional fish managers and the Plaintiffs. Depending on whether sensitive life-stages of fish are present, the Corps and NMFS considered how exceedances to the State water quality standard compared to benefits of the temperature reduction operations. In fall 2021, the Corps and NMFS found that it was more beneficial from a biological perspective to lower temperatures while maintaining TDG below 120% and still complying with the Court's injunction. The Corps and NMFS filed a Proposed Water Temperature Management Operation for Detroit Dam with the Court on October 1, 2021 to notify the Court of the prioritization of water temperature management during implementation of Interim Measures 5 and 7.

In instances where less sensitive salmonid life history stages are present below Detroit and Big Cliff dams, then elevated TDG is likely a lower-risk. However, if sensitive species are present below Detroit and Big Cliff dams, then RO use will be reduced or temporarily curtailed until the TDG levels decline. Curtailment should primarily be considered when sac-fry are present in the reach between Big Cliff and the Minto Fish Facility. In future years, accumulated thermal units (ATUs) should be closely tracked to identify the timing of the emergence of sac-fry, and during this period, RO releases should be modified so as not to exceed 110% as measured downstream of Detroit and Big Cliff dams.

Big Cliff Spread Spill for TDG Abatement (Injunction Measure 10/Interim Measure 6)

Description: Elevated TDG is generated when water is passed through the non-turbine outlets at Detroit and Big Cliff dams. The turbine units at either project are not known to produce increased levels of TDG; however, since the turbines at Detroit Dam can be detrimental to fish and to downstream water temperature (turbines are higher in the dam structure and more likely to release warmer water), these units are purposely operated for fewer hours during specific times of year.

The Big Cliff turbine is less harmful on fish and downstream water temperature and should be utilized to the extent possible to reduce downstream TDG levels. When spill is necessary at Big Cliff Dam, due to maintenance activities or involuntary high flow events (when outflow exceeds the capacity of the turbine), spreading spill across multiple spill bays at Big Cliff Dam will reduce TDG.

This measure directs the Corps to spread spill across multiple spill bays at Big Cliff Dam, when operating the spillway, to reduce TDG levels.

Implementation: The total volume of water that can pass through the turbine intakes varies by reservoir elevation and ranges from 2810 – 3200 cfs. Flows that exceed this range must be split between the powerhouse and spillway and are generally observed during high flow, or involuntary spill events.

The minimum gate opening for spill operations of each spill bay at Big Cliff is 0.75 feet. This equates to discharges that range from 770 cfs – 1130 cfs for reservoir elevations of 1182 ft. (min. conservation pool) and 1206 ft. (max. conservation pool), respectively. Under the lowest of reservoir elevations, flows cannot be spread between two bays until the total outflow is greater than 4740 cfs, which is the sum of the discharge from two spill bays at minimum gate opening plus powerhouse capacity [(770 cfs + 770 cfs = 1540 spill) + (3200 cfs powerhouse) = 4740 cfs total flow]. Under the highest reservoir elevations, flows cannot be spread between two bays until the total outflow is greater than 5070 cfs, which is the sum of the discharge from two spill bays at minimum gate opening plus powerhouse capacity [(1130 cfs + 1130 cfs = 2260 cfs spill) + 2810 cfs (powerhouse) = 5070 cfs (total flow)]. Without large flow conditions, spreading spill is limited at Big Cliff Dam.

From September – December of 2021, the spillway was used during two high flow events, one that occurred in mid-November and the other that occurred in late-December (Figure 6). The first involuntary spill event lasted approximately 15 days, from November 16 through December 01. Spill

discharge was spread across two bays during the peak of this event and when spill discharges were highest, November 17-24.

The second involuntary spill event occurred from December 23 through December 31, or approximately 9 days. Maximum spill discharge observed during this event was 1660 cfs. Spill discharge was not spread across multiple bays during this event due to insufficient discharge to meet minimum gate opening restrictions. As shown in Figure 10 (gray shaded areas), the two spill events resulted in very different downstream TDG conditions. During the first event, total project discharge was higher, and spreading spill was possible, so downstream TDG was approximately 5% lower than the second high flow event (green line highlighted in grey boxes).

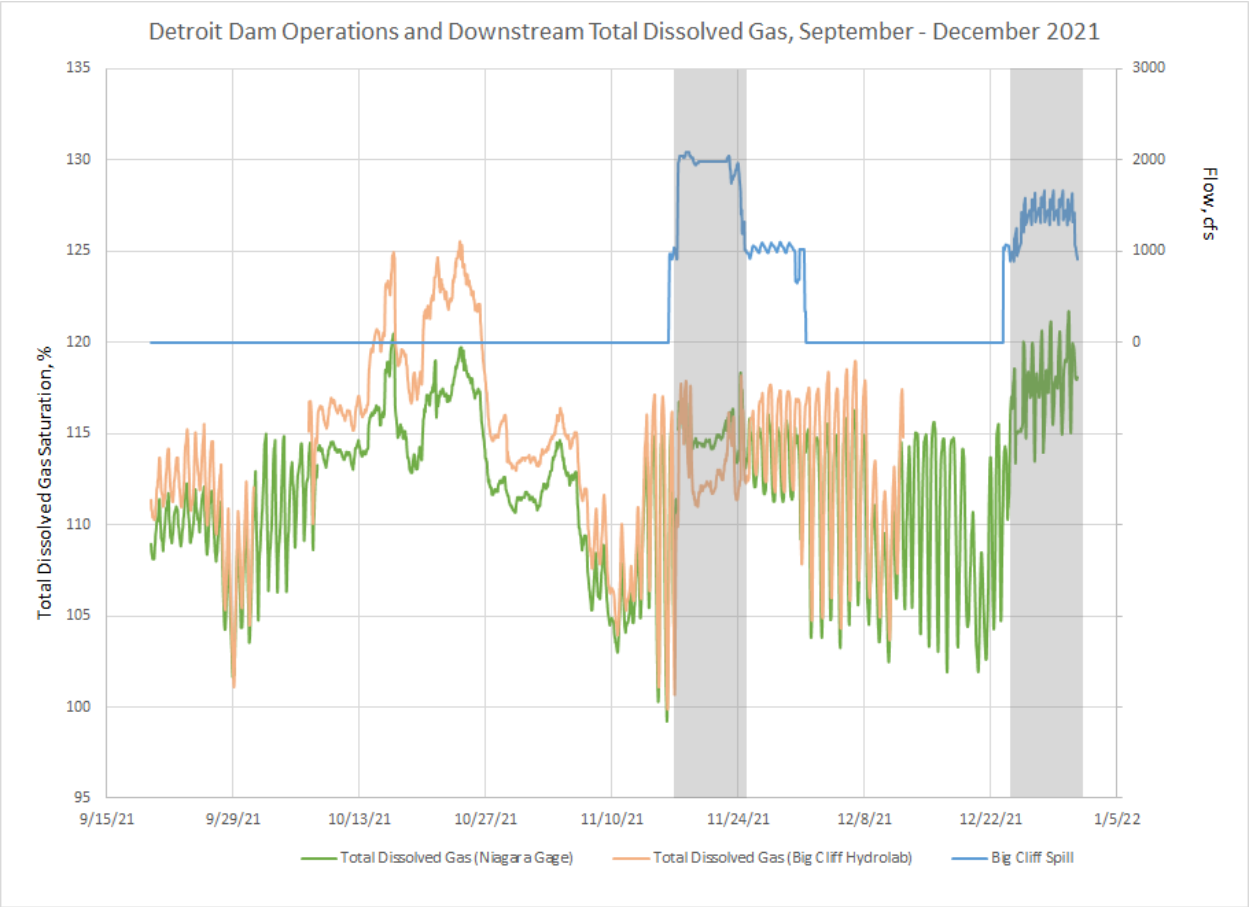


Figure 10. Big Cliff "Spread Spill" Operation and Resultant Downstream Total Dissolved Gas (TDG)

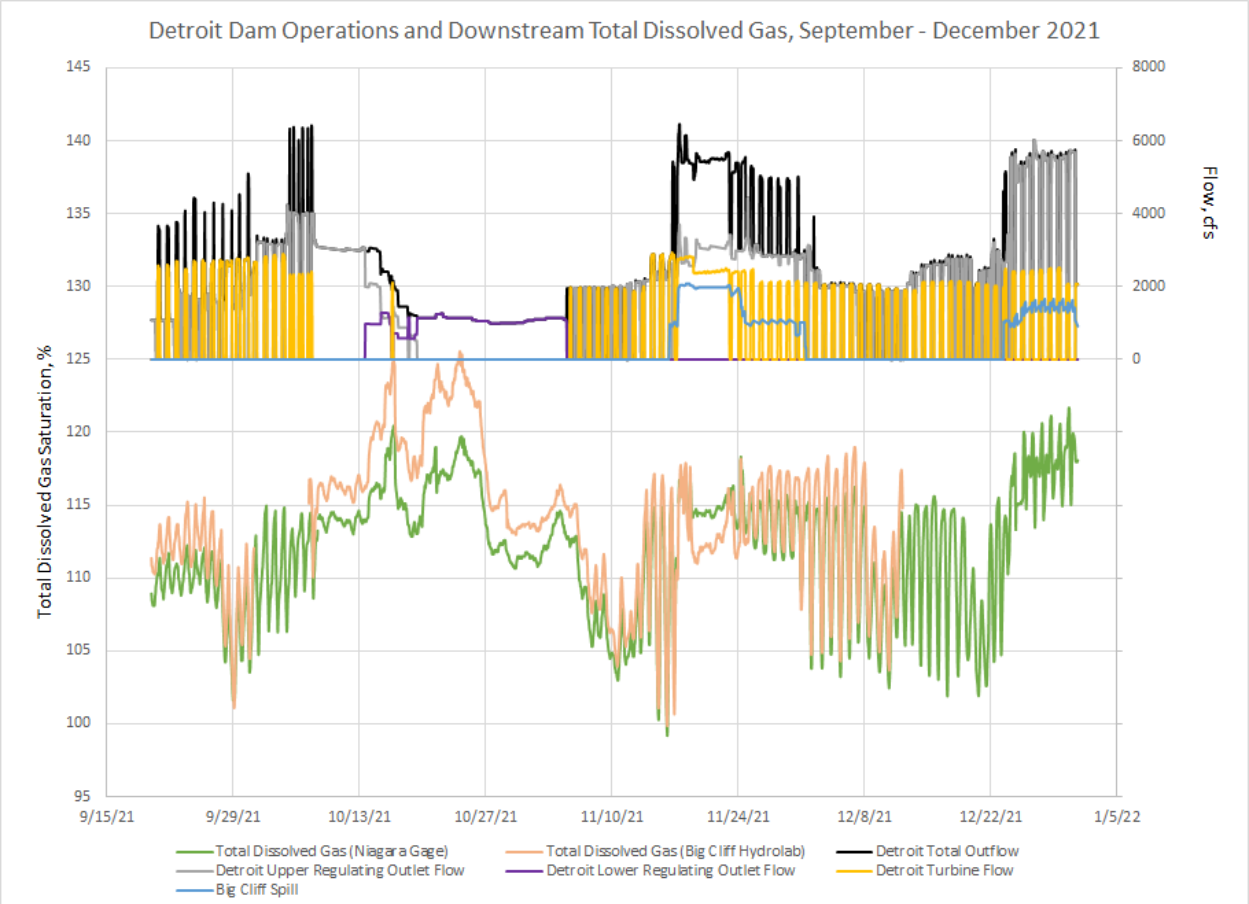


Figure 11. Detroit Dam Operations and Resultant Downstream Total Dissolved Gas (TDG)

RM&E: From mid-September through December a hydrolab was deployed downstream of Big Cliff Dam (orange line in Figure 11, above) to monitor TDG and determine the difference, or degassing rate, between the tailrace and the established Niagara gaging station (green line in Figure 11, above). Due to instrument failure, data is currently only reported through mid-December. The remaining information from mid-December into 2022 will be discussed in the August bi-annual status report.

Generally, TDG was higher in the Big Cliff tailrace than at the USGS Niagara gauge, with the frequency of TDG saturations of greater than 115% TDG occurring 18.7% more often as compared to the Niagara gauge (Table 3). The largest differences in TDG reading between the two locations occurred during the onset of the LRO operation and as URO discharges were reduced to zero (Figure 11) in mid-October.

During Big Cliff spill operations, TDG measured downstream of Big Cliff Dam was lower than that measured at the Niagara gage (Figure 11, before November 24). While this seems like a counterintuitive response given that the Big Cliff tailwater hydrolab recorded higher TDG (as compared to the Niagara gauge) in almost all other instances, the explanation is likely due to the placement of the hydrolab. The Big Cliff hydrolab was deployed on the right side of the river and downstream of the Big Cliff powerhouse, as this was the most accessible location for deployment.

This location, while informative, is not likely a well-mixed location, whereas the Niagara gauge is more so. In other words, the TDG generated by the operation of the Big Cliff spillway, which is located on the left side of the river, did not fully mix in the Big Cliff tailrace before traveling downstream and therefore conditions were not accurately measured by the Big Cliff tailwater hydrolab when the Big Cliff spillway was in operation.

Table 3. Frequency of Total Dissolved Gas as Measured Downstream of Big Cliff Dam and at the USGS Niagara Gauge

TDG Saturation	Big Cliff Tailrace	USGS Niagara Gauge
< 110%	18.0	28.5
110% - 115%	40.8	49.0
115% - 120%	29.9	21.5
120% - greater	11.3	1.0

This information/relationship between the two locations will be applied to the Corps' TDG Calculator (model) and used to shape future operations at Detroit Dam. Additional data collection at Big Cliff is planned in 2022.

Lessons Learned/Future Year Recommendations: When spill is necessary at Big Cliff Dam, some benefit can be realized from spreading spill across the spillway, using multiple spill bays; however, and as described above, minimum gate opening constraints preclude the Corps from spreading spill under many flow regimes. Additionally, TDG is also generated by Detroit Dam operations, particularly when a non-turbine unit is used to discharge water. In this case, spreading spill at Big Cliff Dam does not prevent/abate TDG levels that are generated by Detroit Dam.

On February 10, 2022, the Expert Panel submitted a recommendation to the court to move forward with structural TDG abatement in the North Santiam River. The Corps has established an engineering design team to evaluate the TDG issue in the North Santiam River and develop a reasonable timeline for designing and constructing a structural solution for mitigating excess TDG levels below Big Cliff Dam during spill operations. The Corps will submit the timeline for design and construction to the Court by no later than August 5, 2022.

Detroit Spring Downstream Fish Passage and Summer/Fall Downstream Water Temperature Management (Injunction Measure 10a/Interim Measure 7)

Description: The purpose of this operation is to provide downstream fish passage in the spring and water temperature management throughout late spring and summer at Detroit and Big Cliff dams through strategic use of the spillway, turbines and regulating outlets. Detroit Reservoir is considered a monomictic reservoir; it thermally stratifies in the summer and is warmest at the surface and coldest at depth. The reservoir "turns over" or becomes isothermal (uniform in temperature) each fall or winter and does not ice over.

To take advantage of the thermal stratification that occurs in Detroit Reservoir each summer, the outlets at Detroit Dam, which extend from near the top of the dam (El. 1541 ft.) down to El. 1335 ft.,

have been used in the past to release water at varying temperatures to meet downstream water temperature targets for ESA-listed fish species. This operational downstream water temperature management has been conducted at Detroit Dam since 2008. Surface outlets are used when available during the summer to discharge warmer water temperatures, whereas the deeper turbines and UROs are used in the fall and winter (prior to turnover) to discharge cooler water to meet downstream water temperature targets and mimic natural cooling that is typical of unregulated river systems. Without water temperature management, North Santiam River water temperatures downstream of Detroit and Big Cliff Dams are too cold in the summer and too warm in the fall, negatively impacting downstream ESA-listed fish populations.

Each year and by late fall, the volume of cold water that can be utilized by the UROs is exhausted and fall water temperatures downstream of Detroit and Big Cliff Dams exceed water temperature targets. While there are a set of deeper outlets below the UROs, called the LROs, that are capable of releasing additional deep, cold water, their operation has been limited in the past due to head restriction limitations and past dam safety concerns (see Dam Safety Section below).

Under Injunction Measure 10a, the Expert Panel was tasked with considering and reporting on whether the existing interim downstream water temperature management operation (Interim Measure 7) should be modified to incorporate the more frequent use of the LROs at Detroit Dam for temperature control purposes beginning 2021, and after much deliberation, the Expert Panel agreed to add use of the LROs in the fall. However, the timing of LRO use was debated.

The operability of the LROs is contingent on forebay elevation. The LROs have a head restriction of 200 feet or less, so these outlets cannot be safely operated until the Detroit Reservoir elevation is at or below El. 1465 ft. The Plaintiffs argued for an early drawdown of Detroit Reservoir so that the LROs could be used by October 15, 2021, whereas the Corps and NMFS did not agree it was necessary for, and would potentially be detrimental to, downstream water temperature management to draw down the reservoir early to begin LRO use on that specific date. The Expert Panel submitted an implementation plan on September 8, 2021 for use of the LROs for water temperature management. In an order dated September 21, 2021, the Court adopted the implementation plan and ordered the Corps to draft Detroit Reservoir to elevation 1465 ft. or less by October 15, 2021 to ensure the LROs could be used at that time to alleviate abnormal fall/winter water temperatures (Figure 12).

Implementation: The Corps drafted Detroit Reservoir to elevation 1465' by October 13, 2021. Starting on that date, the Corps opened the LROs for downstream water temperature management with limited reduction in downstream water temperatures (Figure 13). The limited success of this operation is likely due to three factors: (1) hot/dry weather patterns observed in the spring/summer of 2021; (2) low inflows and resultant low reservoir elevations which limited spillway operations; (3) the early drawdown and use of cold water storage in Detroit Reservoir in the fall.

Because of the low reservoir elevations resulting from drought conditions and efforts to meet instream minimum flow targets, Detroit Reservoir was drawn down below the spillway crest in early July and project discharges were shifted entirely to the penstocks. This shift from a surface-oriented outlet to a deeper outlet caused downstream water temperatures to immediately cool since water temperatures at the elevation of the penstocks were much cooler than that at the surface of the reservoir (Figure 14).

In the past, it has been found that prioritizing the use of the spillway for as long as possible (4+ months) to evacuate warm surface water from Detroit Dam during the summer leaves less warm water to contend with in the fall when cooler water temperatures are needed downstream to meet the water temperature targets. This was not possible in 2021; due to drought conditions, insufficient inflows and resultant low reservoir elevations, the Detroit spillway was only operated for two months (Figure 15). Additionally, mainstem flow targets were not met for much of the spring and part of the summer in 2021, and tributary minimum targets were also not met from mid-April to September.

There is a finite volume of cold water in Detroit Reservoir, so once the reservoir was drawn down below the elevation of the spillway, primary use of the powerhouse began, leading to an earlier evacuation of limited cold water. The cooler water ideally would have been saved for later in the fall when cooler downstream water temperatures are targeted (Figure 16).

As turbine operations continued throughout late summer, the volume of accessible cold water was reduced, and downstream water temperatures began to warm. To combat this warming, in early September, the UROs (El. 1335 ft.) were utilized to tap deeper into the reservoir and access cold water again. The volume of cold water accessible by the UROs was depleted quickly however, as large amounts of water were discharged in late-September and early-October to meet the Court-ordered drawdown of Detroit Reservoir to El. 1465 ft., which was achieved on October 13, 2021.

When the reservoir was drawn down to elevation 1465 ft., the LROs were operated. These are the deepest outlets at Detroit Dam, with an invert elevation of El. 1260 ft. Downstream water temperatures cooled by about 5°F for about a week before the available cold water storage at that elevation was exhausted. By late-October the reservoir turned over, mixing the reservoir water from top to bottom, and downstream water temperature management was effectively over (Figure 16). In-river cooling observed from November on was due to environmental factors and was not dictated by dam operations.

The Corps will begin spring 2022 spillway operations for downstream fish passage and downstream water temperature management as contemplated by this measure when the reservoir reaches spillway crest elevation (El. 1541.0 ft) and continue until the reservoir is drafted below the spillway crest. At that point, a combination of turbine and RO discharges will be implemented for continued downstream water temperature management until reservoir turnover.

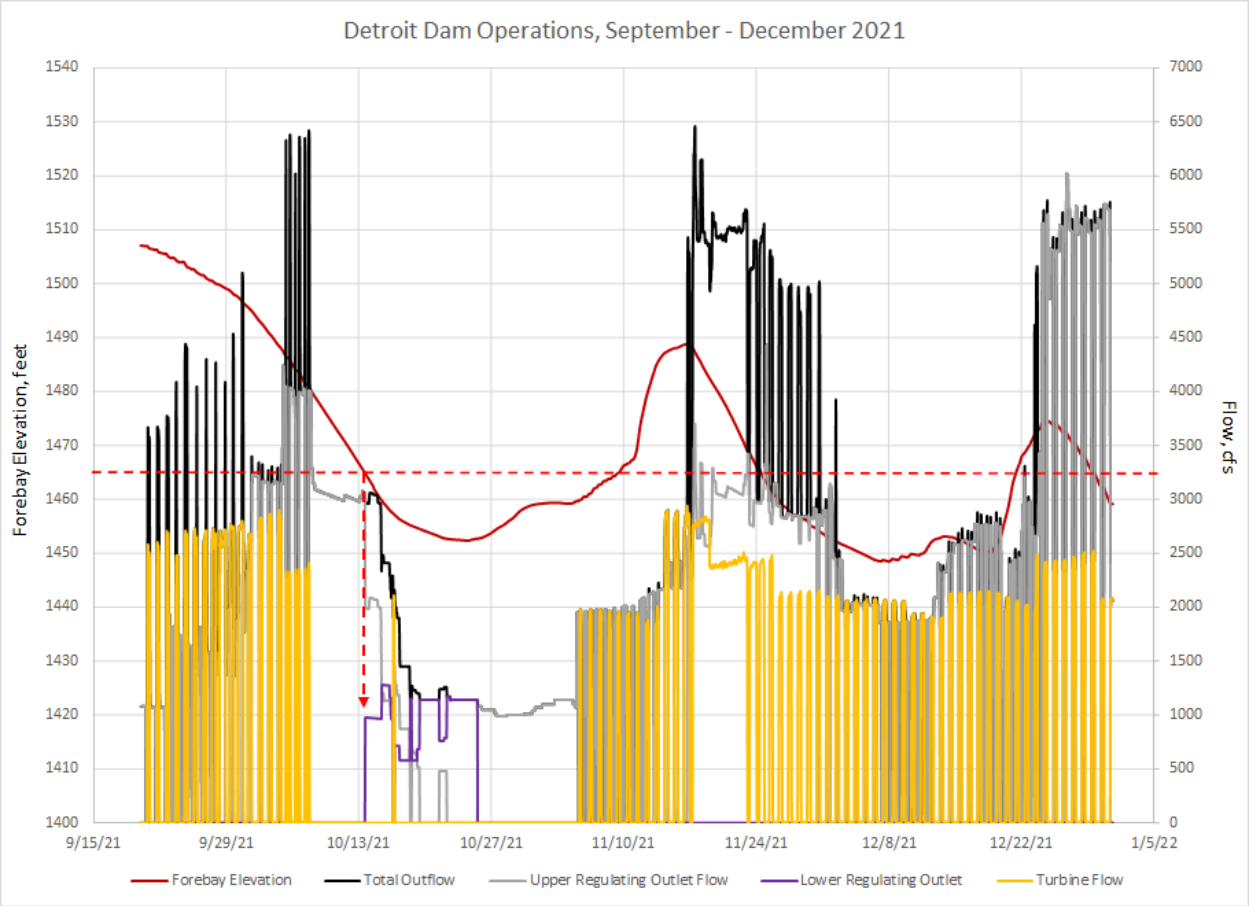


Figure 12. Detroit Dam and Reservoir Operations and Use of the Lower Regulating Outlet, September - December 2021

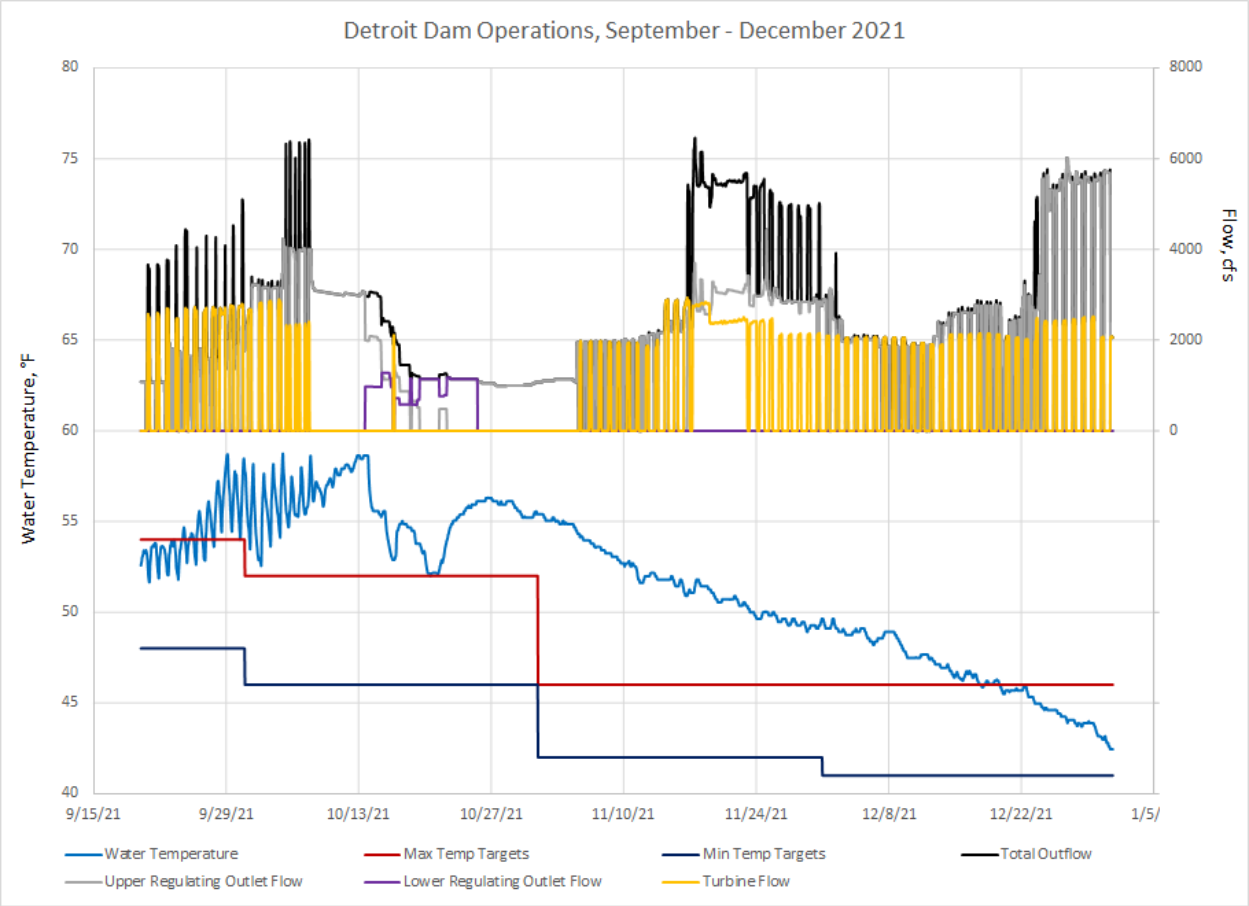


Figure 13. Detroit Dam Operations and Downstream Water Temperatures as Measured at the Niagara Gaging Station

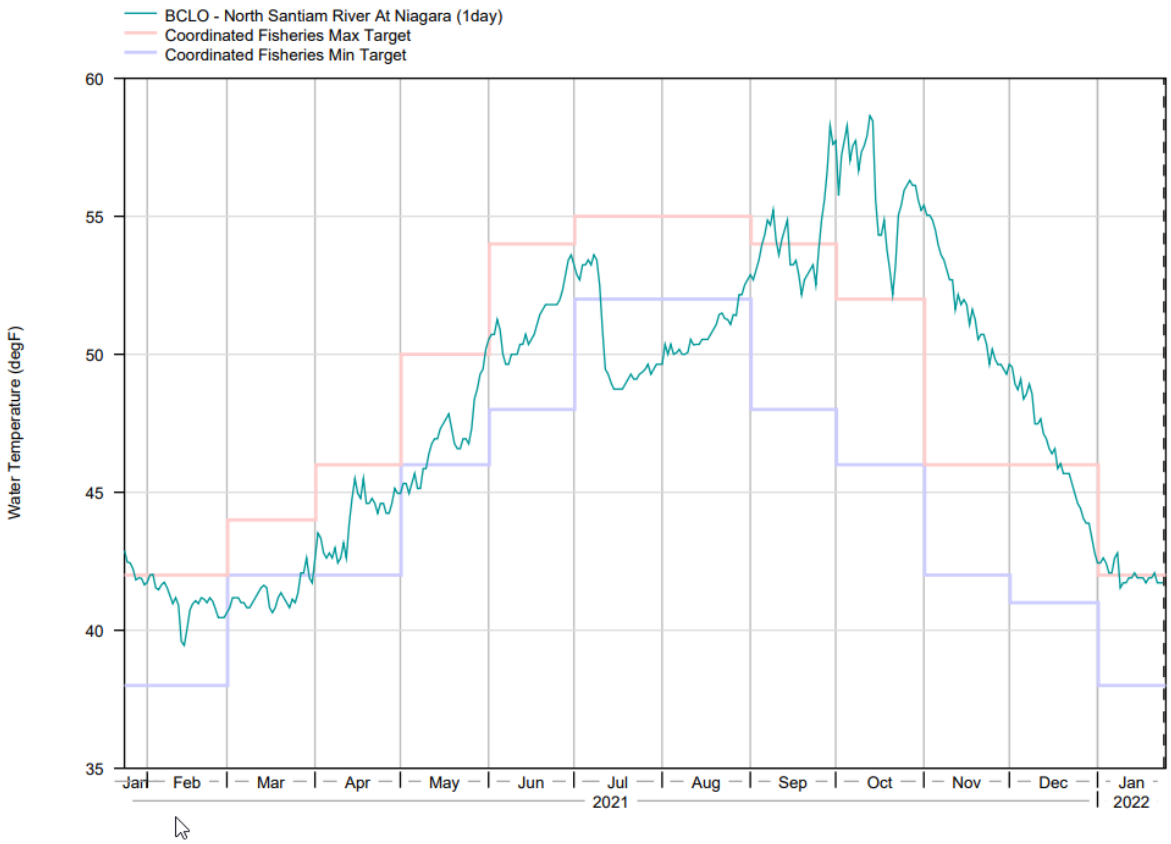


Figure 14. Annual Water Temperatures as Measured at the USGS Niagara Gauging Station, 2021

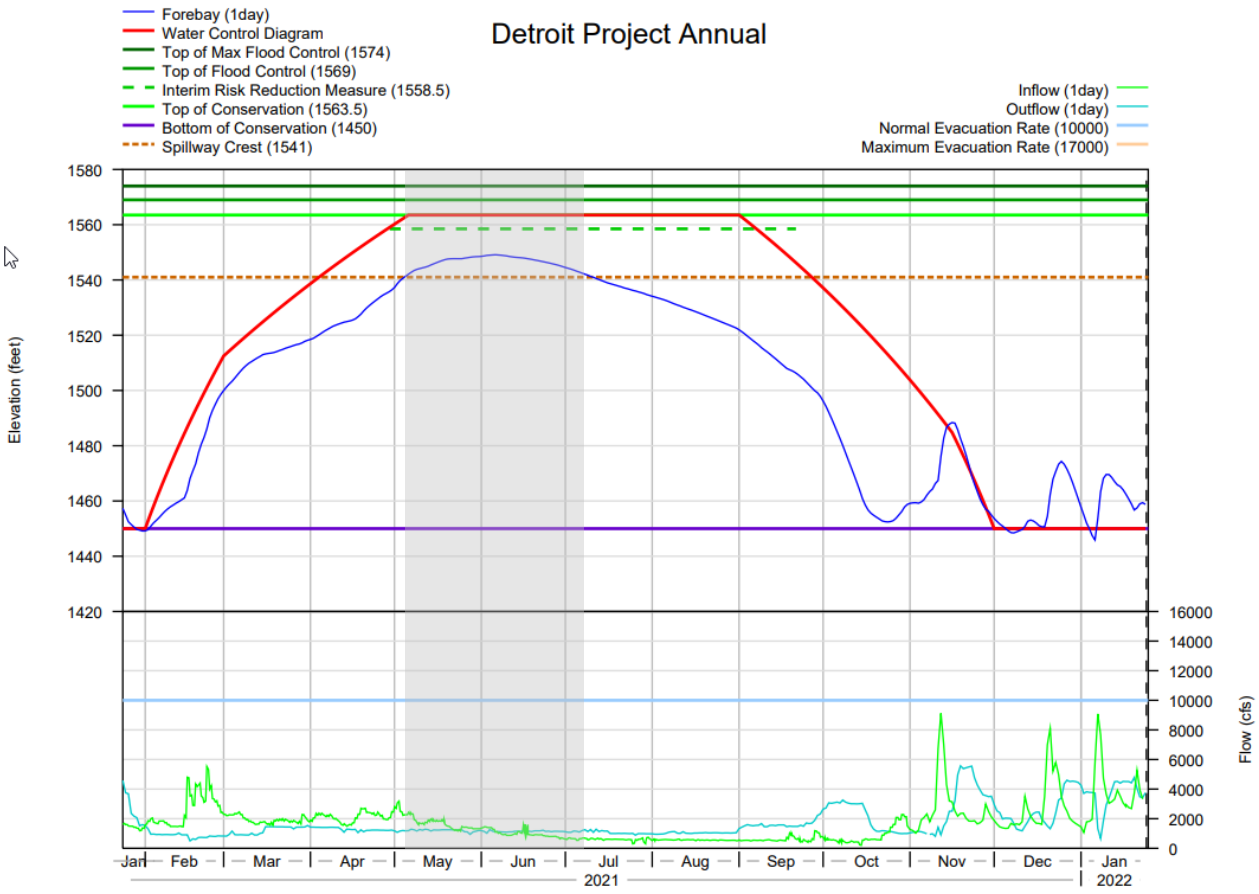


Figure 15. Annual Detroit Reservoir Elevations and Project Outflows, 2021

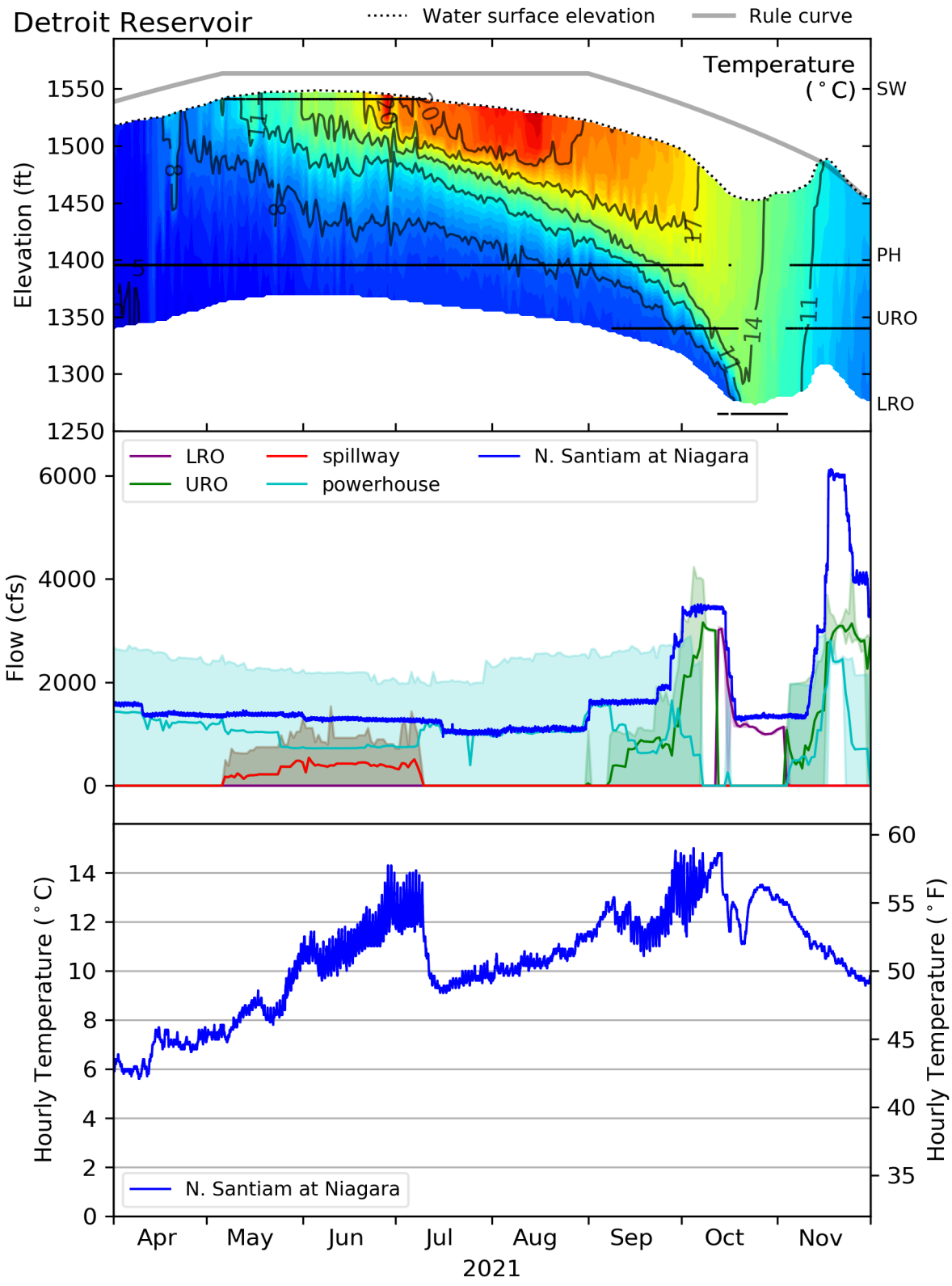


Figure 16. Detroit In-Reservoir and Downstream Water Temperatures and Project Operations, 2021

RM&E: In addition to in-reservoir water temperatures, water temperature and TDG levels were also monitored downstream of Detroit and Big Cliff dams at the USGS Niagara gauge (14181500) located approximately 1.5 miles downstream of Big Cliff Dam. A hydrolab was also deployed in the tailrace of Big Cliff Dam to monitor TDG during the LRO operation. In general, and from what was observed in 2021, it appears that the LRO generates higher TDG than the URO, particularly in the Big Cliff Dam tailrace (orange line vs. green line, Figure 11). This information will be applied to the Corps' TDG Calculator (model) and used to shape future operations at Detroit Dam, possibly with mixing URO and LROs more often.

Rotary screw trap monitoring was conducted below Big Cliff Dam; see previous sections for preliminary results.

Spawning surveys below Big Cliff Dam were performed by the Corps to observe spring Chinook salmon spawning activity, as well as the distribution, density, and morphology of spawning areas for the same survey reach of river over the survey period from 09/08/21 to 10/07/21. Surveyors measured the approximate depth of the water column over the redds for the three different discharge volumes which occurring on each survey date. The presence or absence of live and dead salmon within or near the spawning areas was recorded.

Surveyors observed spring Chinook salmon spawning activity within the survey reach during the survey conducted on 09/08/21, at a discharge of 1580 cfs released from Big Cliff Dam (as read at USGS Station #14181500). 23 redds, 3 live fish, and one post-spawn mortality were observed within spawning areas for the entire survey reach. Minimum water column depth covering redds was over 6 inches.

On 08/21/21, Big Cliff Dam was releasing 1570 cfs, and surveyors observed 51 redds, 44 spawning fish, and 2 post-spawn mortalities. Minimum water column depth over the redds was 3 inches. Most redds were situated in greater than 6 inches of water.

On October 7, 2021, Big Cliff Dam was discharging 3370 cfs. The spawning areas were covered my too great a depth of water to observe spawning activity. No live or post-spawn fish were observed.

A summary of survey observations for the three survey dates can be found in Table 4, below.

Table 4. Table with a summary of numbers of redds at depth by date at different discharge levels.

Date	Discharge cfs	# Redds < 3in	# Redds 3-6 in	# Redds 6–12 in	# Redds > 12 in	Total # Redds	# Live ChS	# Mort ChS
09/08/21	1580	0	0	9	14	23	3	1
09/21/21	1570	0	12	16	23	51	44	2
10/07/21	3370	X	X	X	X	X	X	X

Dam Safety Monitoring: The LROs at Detroit are rarely used. Historically, the operation of the LROs resulted in severe cavitation damage to the concrete conduit, which had to be repaired. Stilling basin and baffle block damage was also observed due to LRO usage. Therefore, dam safety monitoring for this injunction measure will consist of an inspection of the LROs and a hydrosurvey of the stilling basin.

Lessons Learned/Future Year Recommendations: A more thorough investigation of the causes of poor water temperatures in fall and the early destratification of the reservoir are currently underway. This information will be used to better understand the factors that were at play in 2021 including: (1) the hot and dry conditions and instream and mainstem flow targets that reduced the use of the amount of storage and time that the Detroit spillway to discharge warm surface water in the summer; (2) the effect of high discharges and early reservoir drawdown on in-reservoir stratification; and, (3) the timing of the early drawdown, which occurred prior to the surface of the reservoir naturally releasing stored heat (from the warm surface water) back into the environment. When complete, this modeling information will be utilized by NMFS and the Corps to potentially reshape this operation in future years.

South Santiam River Injunction Measures

The South Santiam River is about 63 miles long and drains an area of about 1,000 square miles (Figure 17). The construction of the two Corps dams, Green Peter and Foster, began in 1961 and was completed in 1967. Currently, ESA-listed UWR spring Chinook salmon and winter steelhead are present in the South Santiam subbasin. Only unmarked (presumptive natural-origin) adult spring Chinook salmon and winter steelhead collected at Foster Adult Fish Facility are transported above Foster Reservoir to spawning habitat. No adult salmon or steelhead have been transported above Green Peter Dam in recent years, included 2021. Outplanting above Green Peter Dam is planned in 2022.

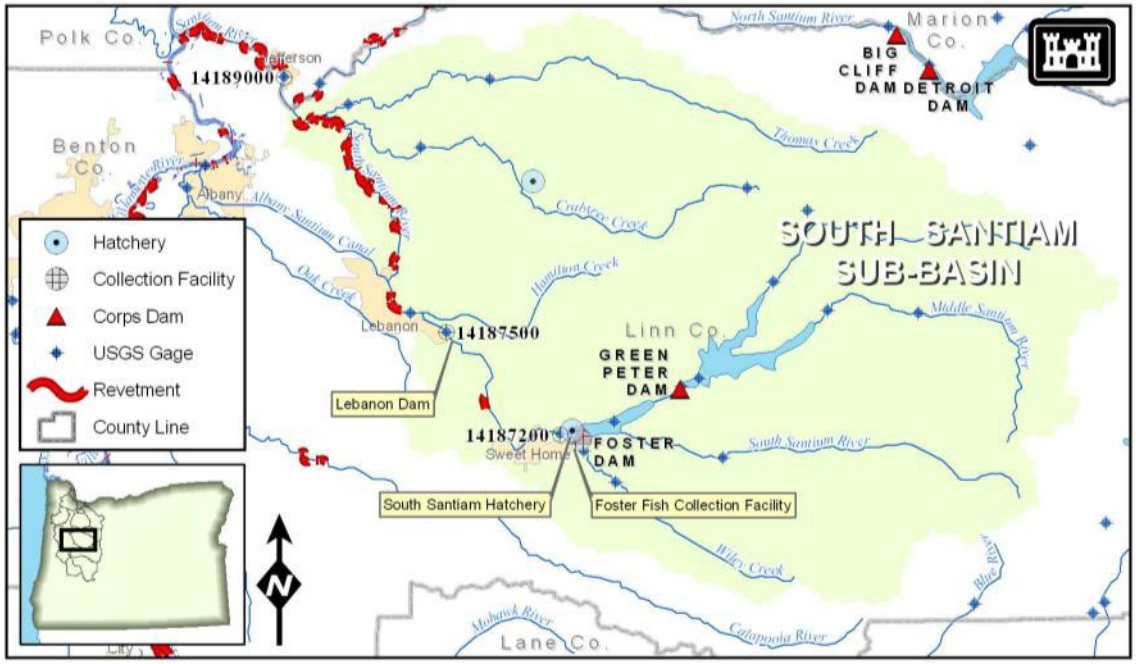


Figure 17. Green Peter and Foster Dams, South Santiam River

Green Peter Outplanting Plan (Injunction Measure 11)

Description: A large portion of the historical spring Chinook salmon and winter steelhead spawning habitat in the South Santiam sub-basin exists above Green Peter Dam. Passage of these species ended in the 1980's due to concerns with reservoir effects and dam passage. Reintroduction (outplanting) of adult Chinook salmon in the watershed upstream of Green Peter, paired with improved downstream fish passage operations at the dam, is likely to benefit the salmon population in the South Santiam basin due to large areas of spawning habitat. On November 5, 2021, the Expert Panel submitted an outplanting plan for this injunction measure to the Court that provided general outplanting goals (number of fish, outplanting timing, etc.), as well as guidelines for release site selection above Green Peter. The Court adopted the implementation plan in an order dated November 29, 2021. Adult fish, captured at the Foster adult fish facility, will be outplanted above Green Peter from May –September 2022. Offspring from these adult salmon are expected to emerge and pass Green Peter Reservoir and dam during 2023.

Implementation: Regional coordination and site selection has commenced and continued coordination with the landowners above Green Peter continues. Potential outplanting sites have been identified. The Corps is working with the U.S. Forest Service, Bureau of Land Management, and private landowners.

RM&E: See the Willamette Project Interim Injunction Measures RM&E Plan for the RM&E planned in out-years.

Lessons Learned/Future Year Recommendations: TBD

Green Peter Spring Downstream Fish Passage (Injunction Measure 12a)

Description: The Expert Panel submitted an implementation plan for a spring spill operation at Green Peter Dam on November 5, 2021, which the Court adopted in an order dated November 29, 2021. Progeny of the outplanted adult fish during 2022 are not expected to outmigrate until early 2023. However, the Corps will implement a spring spill operation in 2022 and RM&E (a baseline study) to evaluate the spill operation and test downstream fish passage efficiency and timing through the reservoir with surrogate juvenile Chinook salmon. The information gathered from the spill operation and baseline RM&E in 2022 will be used to inform the 2023 spring downstream fish passage spill operations and related R&ME of the operation. To date, very little is understood about downstream fish passage via the spillway or through regulating outlets at Green Peter Dam.

Implementation: Beginning in the spring of 2022, spilling will begin once the reservoir reaches spillway crest, or El. 971 ft. A continuous spill release will be implemented until May 1 or for at least 30 days, whichever is longer.

Reservoir elevations during this operation will range from 971 ft. to 1005 ft. and spill will range from a minimum of 460 cubic feet per second (cfs) to 3,000 cfs, based on the Green Peter spillway rating table, with a minimum gate opening of 1.5 feet. Flows of 800 to 1,000 cfs have been shown to

successfully pass juvenile fish at other projects in the region and therefore, are expected to successfully pass fish in the Green Peter reservoir to the spillway for downstream passage.

RM&E: The RM&E planned for this Green Peter spring operation, including a baseline 2022 active tag (radio telemetry) study to evaluate the operation, is in the implementation plan submitted on November 5, 2021. Additionally, the Corps will deploy a single 8 ft. diameter rotary screw trap in the tailrace of Green Peter Dam starting in the spring of 2022. Two 5 ft. diameter rotary screw traps will be deployed above Green Peter in the spring of 2023, when progeny of the outplanted adult fish in 2022 are expected to emerge and outmigrate, along with the rotary screw trap in the tailrace of the dam. Deployment of traps above Green Peter Dam is dependent on receiving permission from local landowners allowing their deployment outside Corps property (Figure 18).

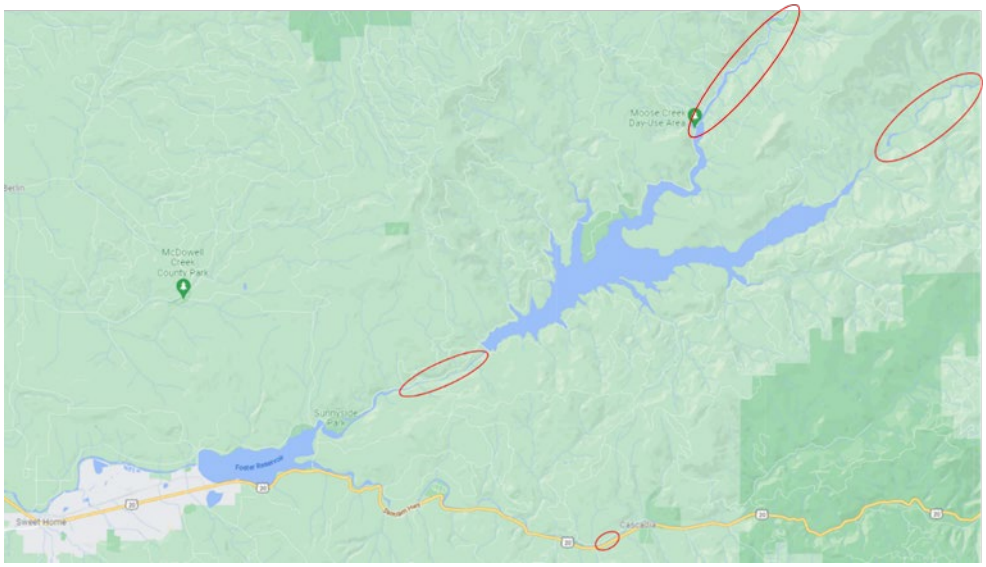


Figure 18. Tentative rotary screw trap sampling locations above Foster Dam on the South Santiam River, on the Middle Santiam River below Green Peter Dam, and above Green Peter Dam on the Middle Santiam River and Quartzville Creek.

Dam Safety Monitoring: Green Peter's stilling basin has existing areas of erosion primarily attributed to usage of the north RO. Monitoring will consist of a hydrosurvey of the stilling basin following the spring spill operation.

Lessons Learned/Future Year Recommendations: TBD

Green Peter Fall Downstream Fish Passage (Injunction Measure 12b)

Description: This plan has yet to be developed by the Expert Panel. An implementation plan is due to be filed with the Court on March 15, 2022.

Implementation: This plan has yet to be developed by the Expert Panel.

RM&E: The Corps will deploy a single 8 ft. diameter rotary screw trap in the tailrace of Green Peter Dam in the spring of 2022 and two 5 ft. diameter rotary screw traps above Green Peter in the spring of 2023. Deployment of traps above Green Peter Dam is dependent on receiving permission from local landowners allowing their deployment outside Corps property (Figure 18).

Additional RM&E planned for Green Peter will be documented in the implementation plan that is due to the Court on March 15, 2022.

Dam Safety Monitoring: TBD

Lessons Learned/Future Year Recommendations: TBD

Foster Spring Downstream Fish Passage (Injunction Measure 13b)

Description: The Expert Panel submitted an implementation plan for a spring spill operation at Foster Dam on October 15, 2021, which the Court adopted in an order dated November 2, 2021. The goal of this spill operation measure is to provide improved downstream fish passage and survival for juvenile spring Chinook salmon and steelhead through Foster Reservoir and past Foster Dam. From February 01 – May 15, the refill of Foster Reservoir will be delayed and held at minimum conservation pool (El. 613-615 ft.). The spillway will be operated at night from one hour before sunset to one-half hour after sunrise; one turbine unit will be operated for station service (~300 cfs), and to reduce/balance TDG levels created by the spill operation. From May 16 – June 15, Foster Reservoir will refill using storage from Green Peter Reservoir and South Santiam inflow. The night spillway-only operations will continue with flows from one turbine as described above.

The fish weir provides warmer surface water from the reservoir to raise river temperatures and aid in attracting adult salmon to the Foster Adult Fish Facility (AFF) for collection, from June 16 to mid/late July. The fish weir will be operated at a 300 cfs flow with the duration of operation depending on storage in both Green Peter and Foster Reservoirs, and biological need (i.e., numbers of adult Chinook collected at the AFF). Close coordination with the Flow Management and Water Quality Team (FMWQT) and the Foster Fish Facility manager will be necessary for the intra-seasonal management of this operation.

Implementation: The Corps began implementation of this operation on February 01, 2022.

RM&E: A single 5 ft. diameter rotary screw trap will be deployed above Foster Dam reservoir on the South Santiam River starting in spring 2022 (Figure 18). In addition, a single 8 ft. diameter rotary screw trap will be deployed below Green Peter Dam starting in spring 2022 and two 5 ft. rotary screw traps above Green Peter Dam starting in spring 2023. Deployment of the trap(s) above Foster Dam on the South Santiam River and above Green Peter Dam are dependent on receiving permission from local landowners allowing deployment outside Corps property. It is not possible to operate a rotary screw trap in the Foster Dam tailrace because of the shallow river environment.

Additional RM&E is planned for this Foster spring operation, including an active tag (radio telemetry) study to evaluate the operation. The detailed RM&E can be found in Willamette Project Interim Injunction Measures RM&E Plan.

Lessons Learned/Future Year Recommendations: TBD

Foster Fall Downstream Fish Passage (Injunction Measure 13a)

Description: The Expert Panel submitted an implementation plan for a fall spill operation at Foster Dam on August 20, 2021, which the Court adopted in the injunction dated September 1, 2021. The goal of this spill operation measure is to provide improved downstream fish passage and survival for juvenile spring Chinook salmon and steelhead through Foster Reservoir and past Foster Dam.

Implementation: Starting just after Labor Day weekend, Foster Reservoir was gradually drawn down to target a forebay elevation of 620-625 ft. by October 01 (Figure 19). Beginning on October 01, the spillway was utilized to pass fish at night, while generation occurred during the day. This operation was carried out through December 15.

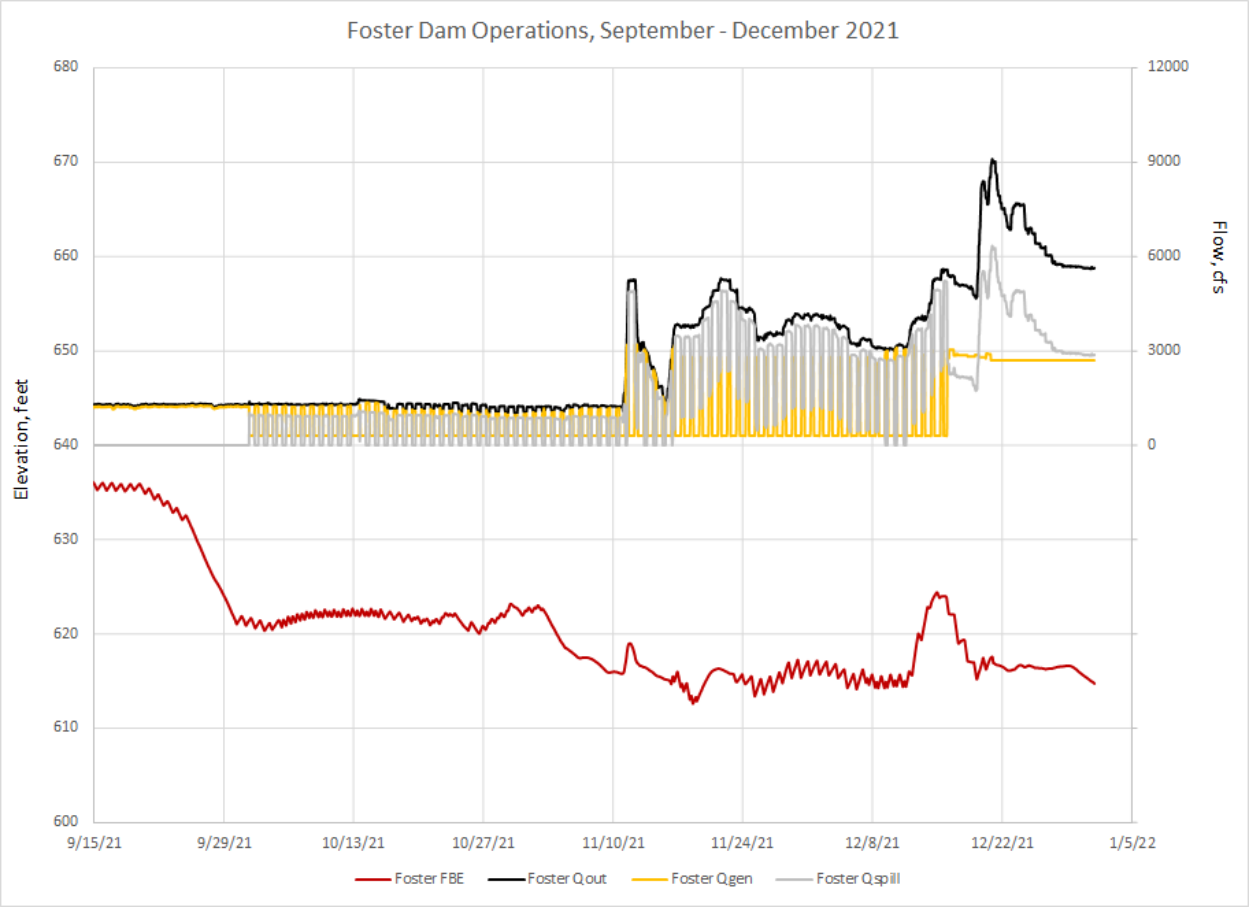


Figure 19. Foster Dam Operations, September - December 2021

RM&E: During the spill operation for downstream fish passage, TDG levels were monitored downstream at the USGS gauging station. Throughout the majority of the fall/winter operation, TDG remained below the State water quality standard of 110%. However, high flow events that

occurred from mid-November through December required Flood Risk Management (FRM) operations and involuntary spill caused TDG exceedances of 1-3% above the standard (Figure 20 and Figure 21).

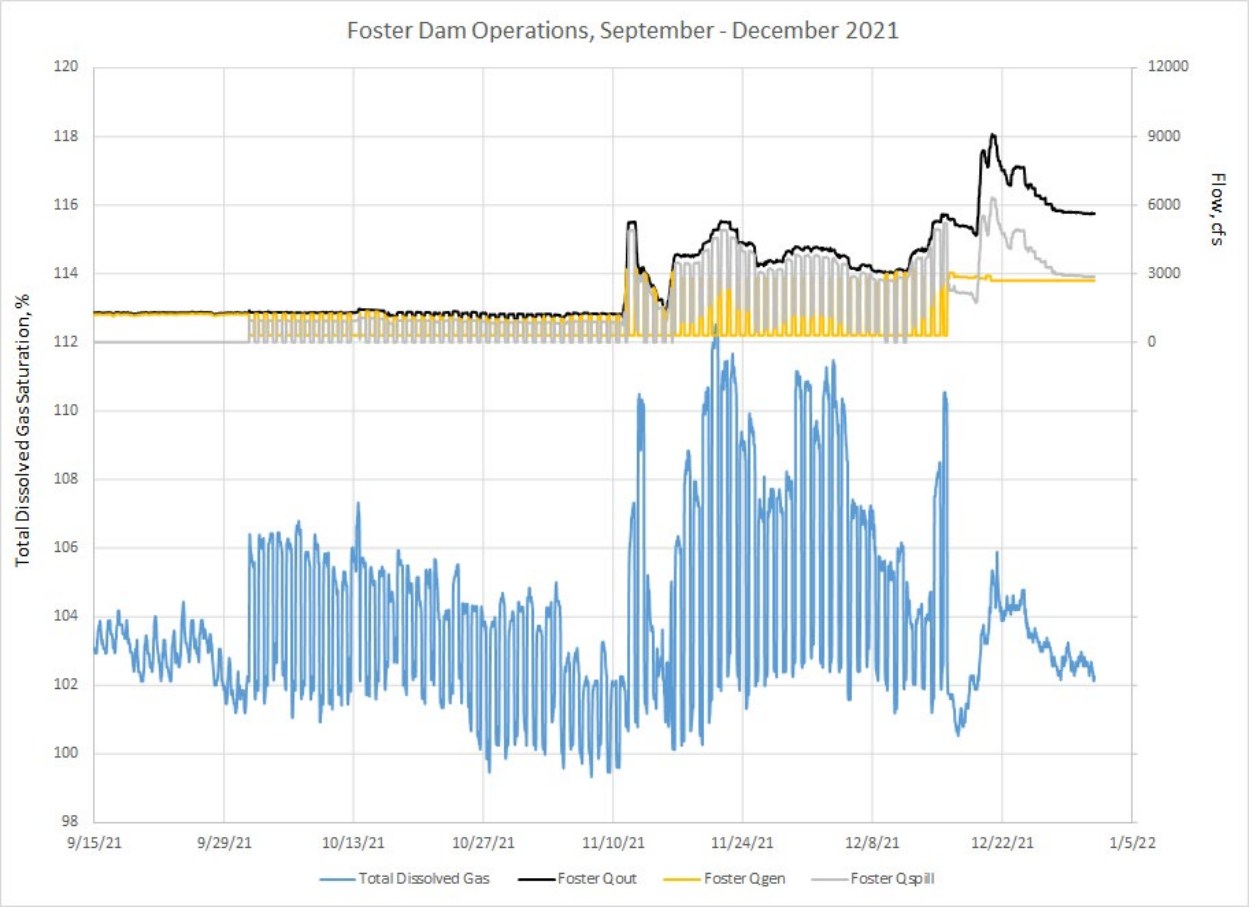


Figure 20. Foster Dam Operation and Resultant Downstream Total Dissolved Gas (TDG)

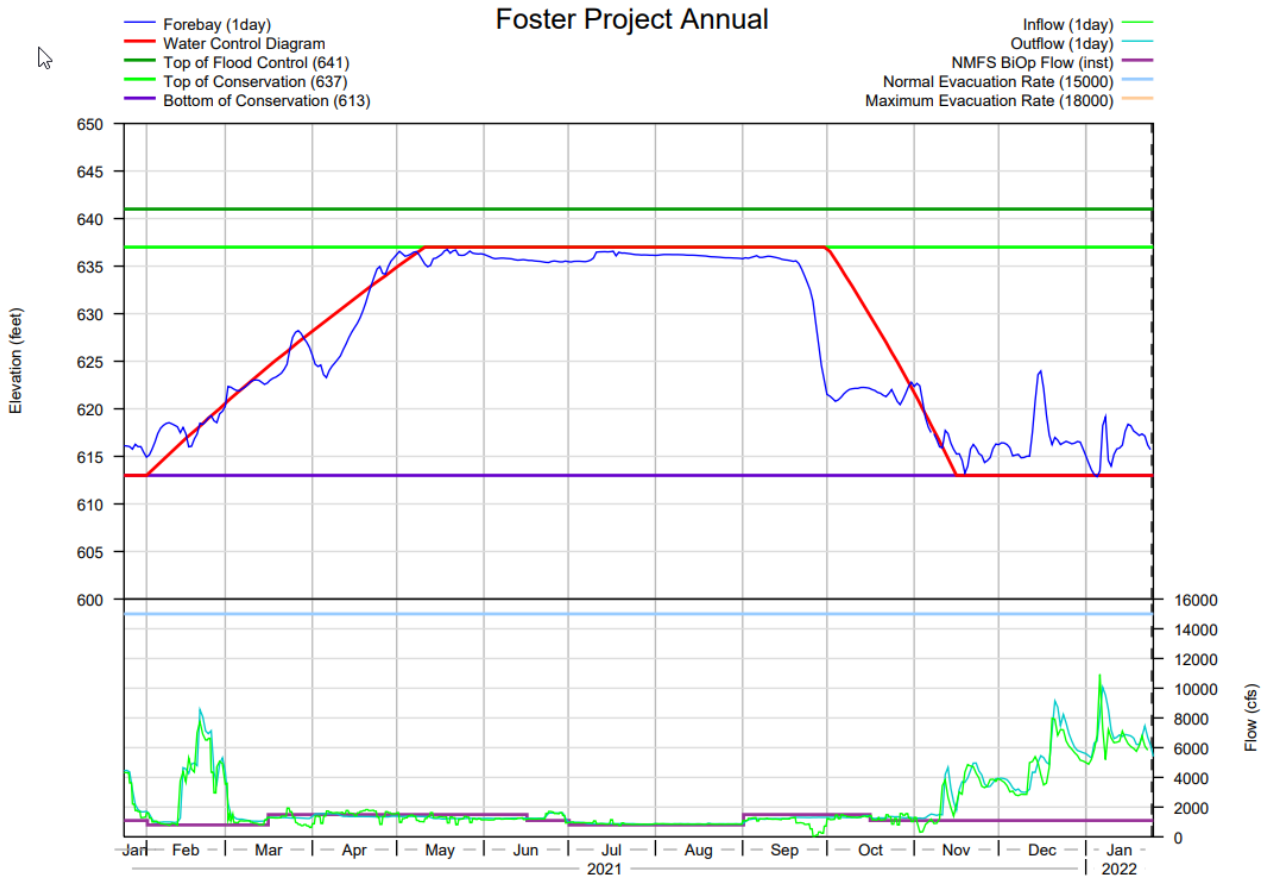


Figure 21. Annual Foster Reservoir Elevations and Project Operations, 2021

No rotary screw trap operations were conducted above Foster Dam in 2021 because of timing and logistics of getting the screw trap in location for this fall operation.

A single 5 ft. diameter rotary screw trap will be deployed above Foster Dam reservoir on the South Santiam River starting in spring 2022 (Figure 18). It is not possible to operate a rotary screw trap in the Foster Dam tailrace because of the shallow river environment. Deployment of the trap above Foster Dam on the South Santiam River is dependent on receiving permission from local landowners allowing deployment outside Corps property.

Spawning surveys were not necessary during 2021 since outflows remained above 1100 cfs.

Additional RM&E is planned for this Foster fall operation in 2022, including an active tag (radio telemetry) study to evaluate the operation. The detailed RM&E can be found in the Willamette Project Interim Injunction Measures RM&E Plan.

<u>Lessons Learned/Future Year Recommendations:</u> Although RM&E was not conducted because of insufficient time after the injunction was issued to plan and fund a study for the fall 2021 operation, past RM&E has shown that this spill operation benefits outmigrating fish, and, thus, the Corps and NMFS expect that the fall 2021 operation benefited fish passage. Additionally, this spill operation

did not violate downstream TDG levels. It is anticipated there will be no modification to this operation for fall 2022.

McKenzie River Injunction Measures

The McKenzie River is about 90 miles long and drains an area of about 1,340 square miles (Figure 22). Two Corps dams were constructed in the subbasin: Cougar Dam at river mile (RM) 4.4 on the South Fork McKenzie River was completed in 1963, and Blue River Dam at RM 1.8 on the Blue River was completed in 1968. Multiple smaller diversions/canals and some higher dams are located on the McKenzie River including Leaburg Dam (RM 29) and the Carmen-Smith Hydroelectric Project (RM 82), both owned by the Eugene Water and Electric Board (EWEB). Leaburg Dam was outfitted with new ladders and a screened diversion intake in 2005-2006.

Cougar Dam blocks access to most of the historic spring Chinook salmon spawning habitat in the South Fork McKenzie, which represents about 25% of the historical spawning habitat in the McKenzie River Sub-basin at large. Blue River Dam and the Carmen-Smith hydroelectric project block smaller amounts of habitat. An artificial spawning channel was built alongside the main McKenzie River just below Trail Bridge Dam to mitigate for lost habitat. The EWEB is also proposing to install a new ladder and screen at Trail Bridge Dam, the lowermost dam of the Carmen-Smith complex, to enable reestablishment of Chinook salmon into historical habitat. High quality habitats remain accessible in significant portions of the subbasin not blocked by dams, but habitat degradation in the Mohawk watershed from a century ago (Parkhurst et al., 1950) and historically significant rearing habitat in the upper Willamette River mainstem has been lost or damaged (NMFS 2008). Currently, ESA-listed spring Chinook and bull trout are present in the McKenzie subbasin.

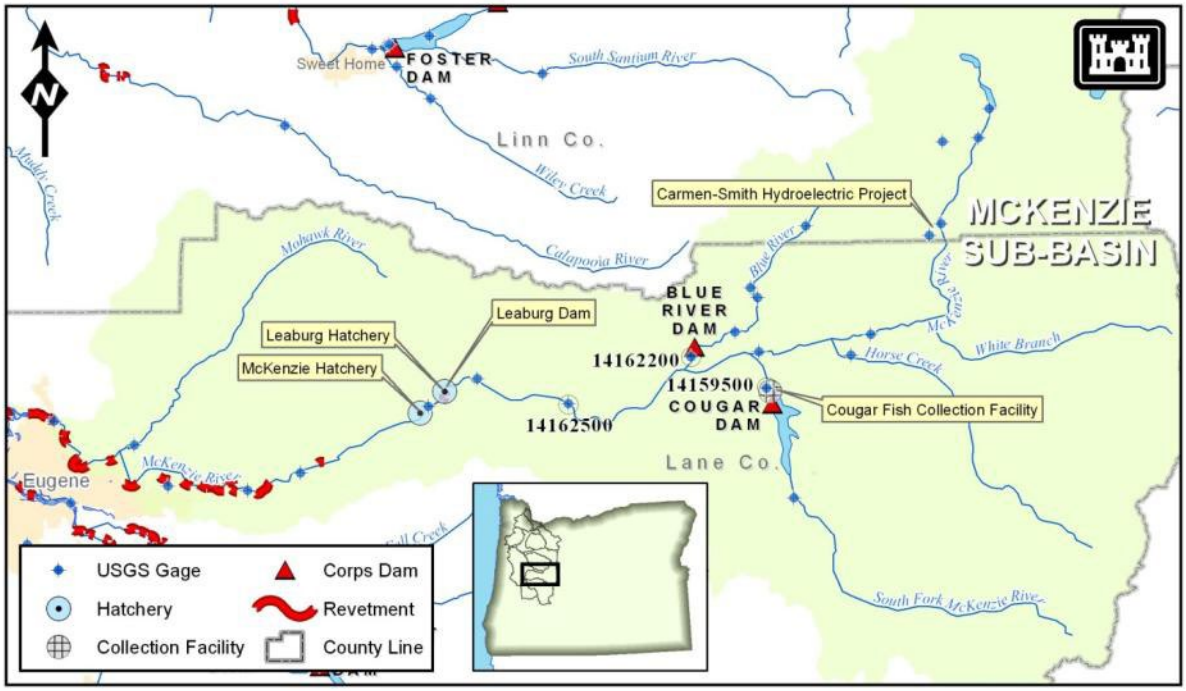


Figure 22. Cougar Dam, South Fork McKenzie River

Cougar Fall Drawdown for Downstream Fish Passage (Injunction Measure 14)

Description: The Expert Panel submitted an implementation plan for a fall drawdown Cougar Dam on August 20, 2021, which the Court adopted in the injunction dated September 1, 2021. This plan included a strategy for drawing down Cougar Reservoir below minimum conservation pool (El. 1532 ft.) to provide more of a surface-oriented flow through the regulating outlets, which are known to provide safer passage than the turbine units. This drawdown targeted an elevation of El. 1505 +/- 5 ft, or approximately 27 ft below normal winter reservoir elevation.

Implementation: Implementation of this measure began as soon as it was ordered. As the drawdown began, outflows, which are typically 400 cfs in the fall (per the Willamette BiOp), were increased to 700 -750 cfs. This was the flow required to reach the target elevation by early November while ensuring healthy riverine conditions downstream for spawners (river depth/width and TDG levels). The reservoir elevation reached 1505 ft. on November 03, 2021.

The ROs were prioritized throughout the implementation of this operation. However, some station service (a 150 cfs release through the turbine unit) was required early on to ensure no loss of remote flood risk management capability due to issues with the operability of the emergency diesel generator, which is the only automatic back-up power source for the facility in the event of an unanticipated loss of line power. As shown in Figure 23 below, station service was provided throughout most of September and October (yellow line). In early November, the turbine unit was used again to release the remaining storage from the reservoir and prior to the large rain event that occurred on November 10. This was the last time the turbines were used until refill in December, when the operations transitioned to nighttime RO releases and daytime generation.

During the second, larger November storm and flood risk reduction (FRM) event (second grey box, Figure 23), the Corps and NMFS jointly decided to allow the reservoir to fill rather than use the turbines to increase outflows out of Cougar Dam. The reservoir refilled to el. 1515 ft. The Corps and NMFS developed a strategy to manage water releases following this and future storm events. Once the storm passed, ROs discharges increased to draw the reservoir back to the targeted elevation of 1505 ft. as quickly as possible. The Corps and NMFS notified the Court of this strategy on November 16, 2021 and filed a motion requesting that the implementation plan be modified to incorporate the strategy on November 19, 2021, which the Court granted in an order dated November 29, 2021.

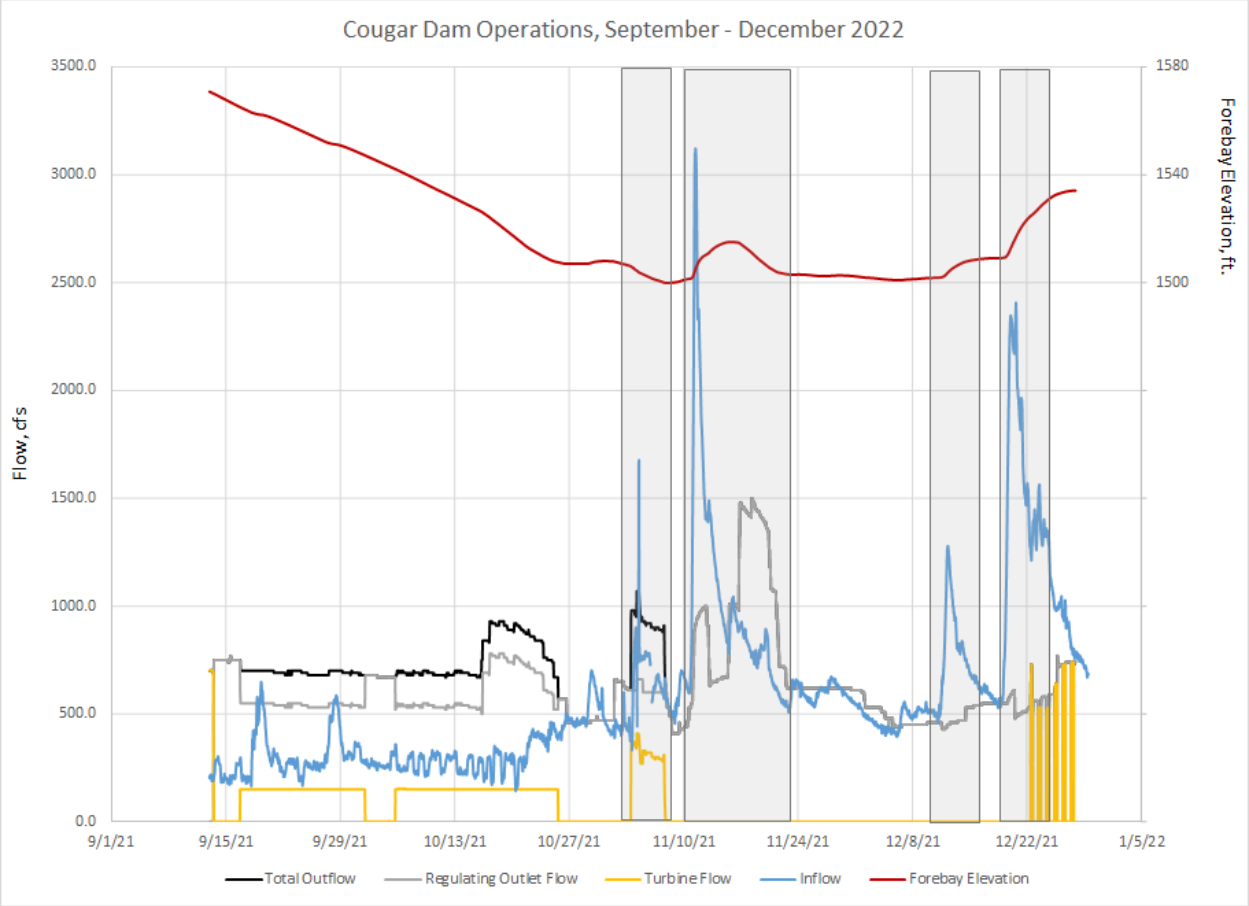


Figure 23. Cougar Dam and Reservoir Operations, September - December 2021

The ROs at Cougar Dam are known to produce elevated downstream TDG when releases are in excess of 800 cfs, so this operation was thoroughly discussed prior to implementation; and, while these releases did create elevated downstream TDG (Figure 24), the Corps and NMFS both agreed that the elevated TDG was likely less harmful to the Chinook life history stages present than increasing turbine unit flow while still complying with the Court's injunction. In other words, modest increases in downstream TDG were expected to be less detrimental to the life history stages in that reach at that time of year than passing juvenile fish through the turbine units.

Two December storms occurred, which caused Cougar Reservoir to rise, with the second storm coinciding with refill. Cougar was refilled back to El. 1516 ft. on December 20 and El. 1532 ft. on December 25. Nighttime RO usage and daytime generation began on December 22. This operation will continue through early summer and while the spring delayed refill operation (Inunction Measure 15a) is being implemented.

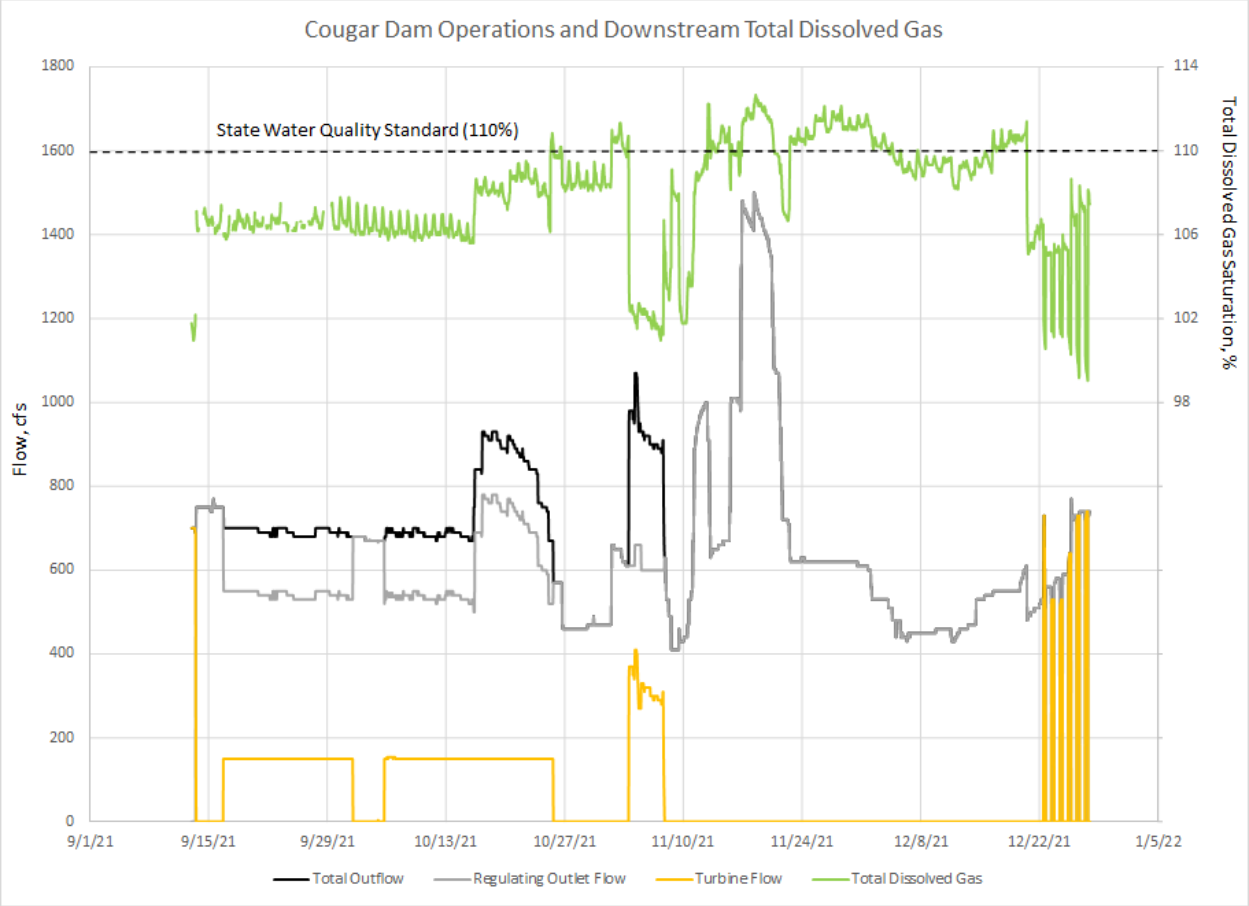


Figure 24. Cougar Dam Operations and Downstream Total Dissolved Gas, September - December 2021

RM&E: The Corps operated three rotary screw traps (RSTs) in the Cougar Dam tailrace to monitor downstream juvenile fish passage through Cougar Dam (Figure 25, Figure 26) during this operation. Two, 8-ft diameter RSTs were operated in parallel in the powerhouse channel and one, 5-ft diameter RST was operated in the regulating outlet channel (Figure 26). No rotary screw trap was deployed below the spillway gates as the spillway is only used in emergencies and has not been used to date at Cougar Dam. The Cougar Dam diversion tunnel has not been used since dam construction and was also not used during this period, so no rotary screw trap was deployed below that outlet either. These traps will continue to be operated year-round as necessary to meet requirements identified in the Willamette Project Interim Injunction Measures RM&E Plan.

Results of monitoring for the September through November 2021 period are summarized briefly herein with additional reporting to be presented in future monitoring reports. Preliminary data is subject to revision as it is undergoing QA/QC procedures. Future reports will compare RST catch under the injunction operations to previous operations.

The RSTs captured fish throughout the sampling period with peak captures occurring in the October-November timeframe via the RO passage route (Figure 27, Figure 28, Figure 29).

As specified in the Cougar Dam implementation plan, a post collection holding study was initiated in September 2021 wherein the first 50 live juvenile Chinook captured per week were held for 24 hours and subsequently assessed again before release (Table 5). For each week, defined as Sunday to Saturday, the first 50 live juvenile Chinook salmon captured in the Cougar Dam tailrace rotary screw traps were held for 24 hours to document subsequent mortality with priority given to utilizing fish collected in the RST below the RO. This resulted in ten 24-hour post-capture holding 'trials' between the weeks of 19 Sept 2021 and 21 November 2022 ultimately for 498 juvenile Chinook salmon captured below Cougar Dam (Figure 29). A total of 111 mortalities across these 10 trials were observed for a total mortality rate of 22% with weekly mortality rates ranging from 4-36% during this period. On average, mortalities and survivors were of similar size (138 mm vs 135 mm) and presented with a similar number of adverse conditions (e.g., descaling, copepods infestations) per individual (1.5 vs 1.4). However, mortalities were more likely to have descaling over more than 20% of their body, more likely to be infested with copepods, and had more severe copepod infections when compared to fish that survived the 24-hour holding period (Table 5). These results as well as those for trials beyond 30 November 2021 will be presented in future reports. It is important to note that results of these holding trials, conducted as specified in the Cougar Dam implementation plan, should be interpreted cautiously due to several study design limitations. For example, it is unknown to what degree factors such as route of passage, dam operations, bias and injuries associated with capture and handling in rotary screw traps affect results based on the small sample sizes and limited scope of the holding study.

Figure 25. Cougar Dam Tailrace depicting rotary screw trap deployment locations in the powerhouse (PH) and Regulating Outlet (RO) channels.

Figure 26. Cougar Dam Tailrace depicting rotary screw trap (RST) deployment locations in the powerhouse (PH) and Regulating Outlet (RO) channels. Upper right photo shows the two 8 foot diameter RSTs deployed in the PH channel in 2021. Bottom right photo shows the 5 foot diameter RST in the RO channel. The Cougar Dam spillway gates and diversion tunnel were not used during this period and therefore not represented herein.

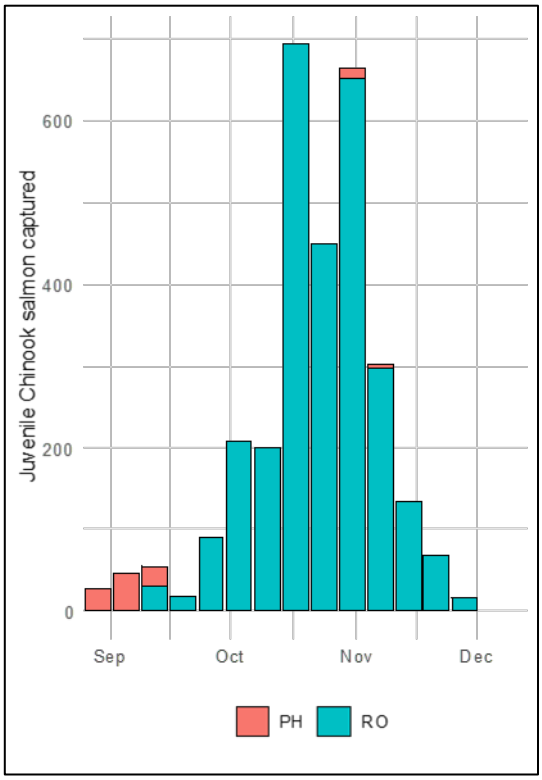


Figure 27. Weekly catch of juvenile Chinook salmon captured in the rotary screw traps below Cougar Dam via the Powerhouse (PH) and Regulating Outlet (RO) during the September to November 2021 time period. These results represent direct capture of juvenile spring Chinook and have not been adjusted for rotary screw trap capture efficiency or sampling effort. Rotary

screw trap data for sampling after 30 November 2021 will be reported in future reports. Please note that data contained herein is subject to revision as this data is preliminary and undergoing QA/QC procedures.

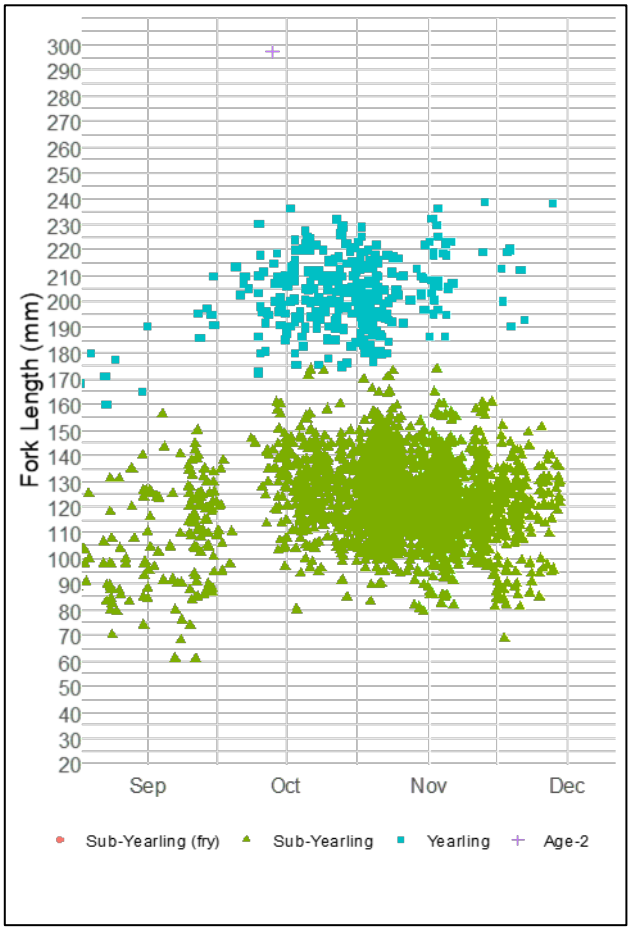


Figure 28. Fork lengths, age-classes and capture dates of juvenile Chinook salmon captured in the rotary screw traps below Cougar Dam during the September to November 2021 time period for Regulating Outlet (RO) and Powerhouse (PH) routes combined. These results represent direct capture of juvenile spring Chinook and have not been adjusted for rotary screw trap capture efficiency or sampling effort. Rotary screw trap data for sampling after 30 November 2021 will be reported in future reports. Please note that data contained herein is subject to revision as this data is preliminary and undergoing QA/QC procedures.

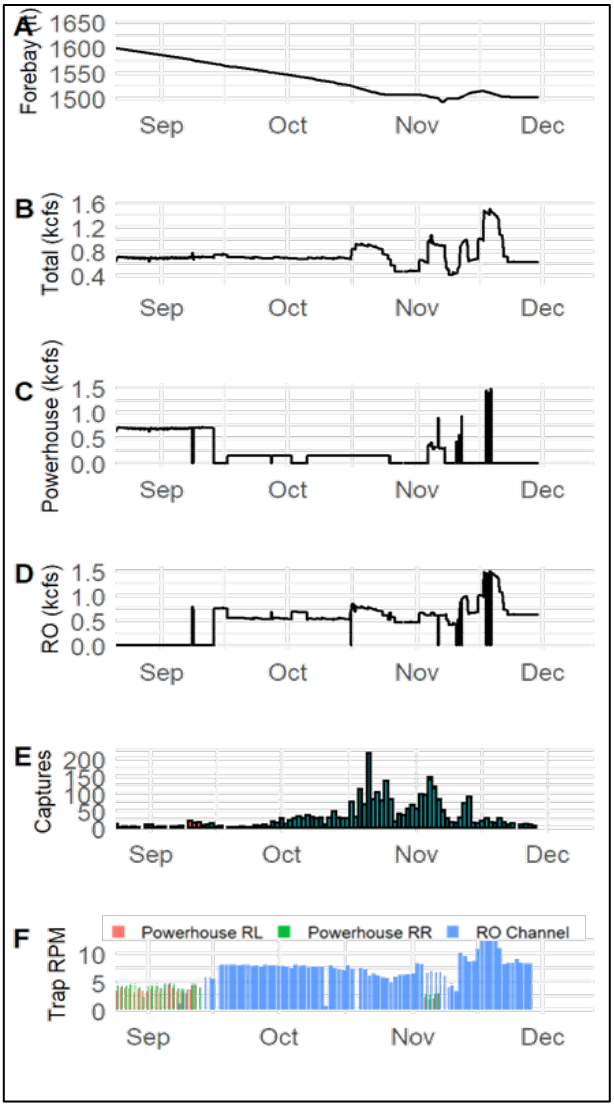


Figure 29. Cougar Dam tailrace monitoring via rotary screw traps in powerhouse (PH) and regulating outlet (RO) channels for the September to November 2021 period. Forebay elevation (panel A), total outflow (panel B), powerhouse (PH) flow (panel C), regulating outlet (RO) spill (panel D), and captured Chinook salmon (panel E) below Cougar Dam, 2021. Chinook captures (panel E) represents direct capture of juvenile spring Chinook; data has not been adjusted for screw trap capture efficiency or sampling effort. The Cougar Dam spillway gates and diversion tunnel were not used during this period and therefore not represented herein. Rotary screw trap data for sampling after 30 November 2021 will be reported in future reports. Please note that data contained herein is subject to revision as this data is preliminary and undergoing QA/QC procedures.

Table 5. Results of the 24-hour post-capture holding trial at Cougar Dam for the weeks of 19 September 2021 to 30 November 2021. The first 50 live juvenile Chinook per week were held for purposes of these holding trials with priority on utilizing fish from the

Week	Subjects	Mortalities	Mort Rate	Mean Subject Length (mm)	Mean Mort Length (mm)	Mean Subject Injuries	Mean Mort Injuries	Mean Subject Copepods	Mean Mort Copepods
9/19/2021	13	2	0.15	180.2	141.0	1.4	2.0	12.1	13.0
9/26/2021	47	13	0.28	149.1	150.8	0.7	1.2	8.3	10.2
10/3/2021	88	32	0.36	146.9	142.6	0.9	1.1	8.5	8.9
10/10/2021	50	11	0.22	147.8	133.0	0.8	1.0	9.9	7.7
10/17/2021	50	14	0.28	139.6	153.6	0.9	1.1	8.9	12.3
10/24/2021	50	16	0.32	130.4	133.1	1.2	1.3	5.7	6.9
10/31/2021	50	12	0.24	124.2	116.0	1.8	2.4	4.0	4.5
11/7/2021	50	6	0.12	121.3	121.5	2.6	3.0	4.5	7.5
11/14/2021	50	2	0.04	113.3	134.0	2.2	2.5	3.4	6.0
11/21/2021	50	3	0.06	122.0	123.7	2.2	4.7	4.5	3.7

Dam Safety Monitoring: The Cougar fall drawdown and spring delayed refill required additional visual monitoring and weekly evaluation of dam safety instrumentation data (piezometers, weirs) as well as a set of inclinometer readings during the drawdown. Cougar Dam has a past performance history of differential settlement since original construction and first filling that has increased during previous drawdowns below the minimum conservation pool. Monitoring will continue into the 2022 conservation storage and release season and evaluation of impacts to Cougar Dam will be completed once the dam has been refilled to at or near summer conservation pool elevation and crest profile and survey of the surface displacement monuments is completed.

Lessons Learned/Future Year Recommendations: During implementation of this measure, the Corps did experience issues with the temporary low-level forebay elevation sensor that measures real-time forebay elevations that extend below the normal operating elevations of Cougar Reservoir. It's critical to have fully functioning elevation monitoring equipment in place during the implementation of this measure to ensure that the reservoir is not drawn down below the natural saddle dam (or ridge) that exists in the reservoir. When the reservoir is drawn down below the saddle dam (El. 1485 ft.), the main reservoir is cut off from the cul-de-sac where the Cougar Dam outlet structures exist, impacting connectivity between the main reservoir and cul-de-sac and impeding downstream fish passage. As such, Cougar Reservoir should not be drawn down below the elevation of the saddle dam during fish passage operations.

In 2022, a permanent low-level forebay elevation gauge will be installed in Cougar Reservoir to eliminate uncertainties in forebay elevation readings during the implementation of Injunction Measure 14.

Cougar Spring Downstream Fish Passage (Injunction Measure 15a)

Description: The Expert Panel submitted an implementation plan for a delayed refill of Cougar Reservoir on October 15, 2021, which the Court adopted in an order dated November 2, 2021. The purpose of this measure is to improve the survival and timing of passage for outmigrating juvenile spring Chinook in spring by delaying refill and providing passage through the dam's regulating outlet. By holding the pool at a lower elevation and providing a safer route of passage during juvenile migration, more juvenile Chinook salmon are expected to pass during the spring.

Implementation: On February 01, the refill of Cougar Reservoir will be delayed until May or June depending on water conditions (i.e., abundant, adequate, insufficient or deficit water conditions). In dry years, Cougar Reservoir may be refilled as early as May 01, while in wet years, refill may not begin until June 01. The goal is to start refill early enough that the reservoir can reach El. 1571 ft. by summer so that the Cougar Water Temperature Control Tower (WTCT) weirs can be used for downstream water temperature management.

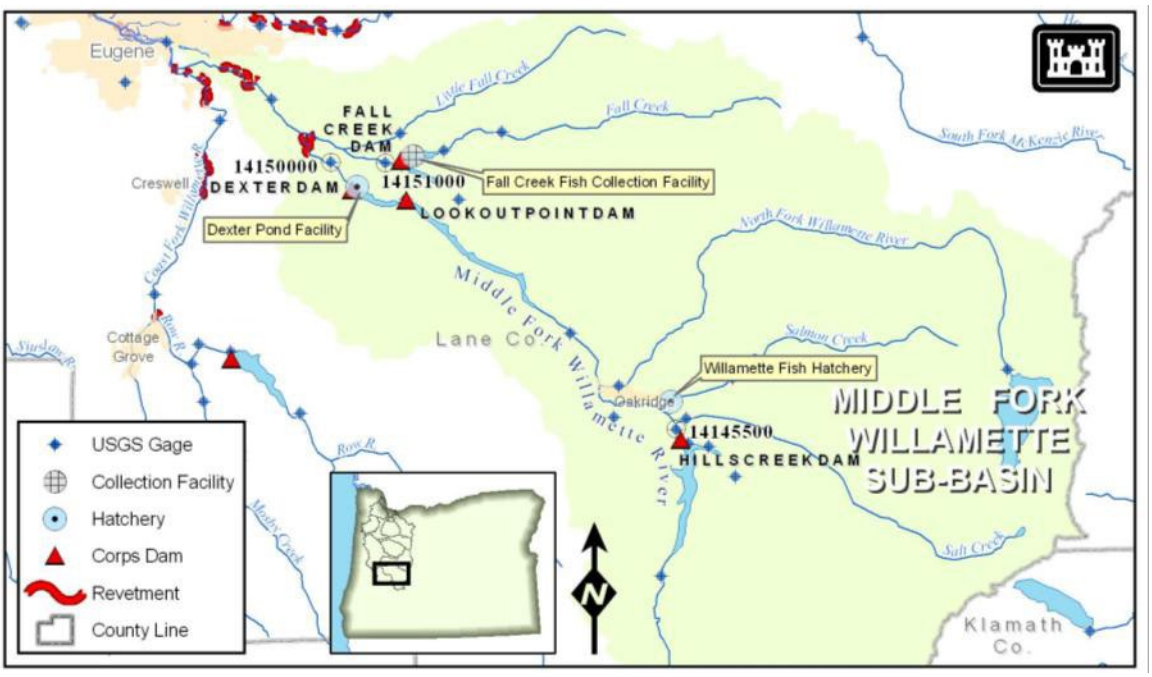
RM&E: Rotary screw traps will be operated in the Cougar Dam tailrace year-round (Figure 25, Figure 26). These traps began operating March 24, 2021 and will continue sampling as specified in the Willamette Project Interim Injunction Measures RM&E Plan. See Cougar Fall Drawdown for Downstream Fish Passage (Injunction Measure 14) for rotary screw trap results from mid-September to November 2021. Please note that data contained herein is subject to revision as this data is preliminary and undergoing QA/QC procedures.

Additional RM&E planned for Cougar can be found in the Willamette Project Interim Injunction Measures RM&E Plan.

Lessons Learned/Future Year Recommendations: TBD

Middle Fork Willamette River Injunction Measures

The Middle Fork Willamette subbasin drains about 1,370 square miles (Figure 30). Four Corps projects were constructed in the subbasin. Hills Creek Dam on the Middle Fork Willamette River (RM 47.8) was completed in 1961. Lookout Point (RM 19.9) and Dexter (RM 16.8) dams on the Middle Fork Willamette were completed together in 1955. Fall Creek Dam on Fall Creek (RM 7.9) was completed in 1965. The four projects are a barrier to upstream fish passage. Currently, ESA-listed UWR spring Chinook and bull trout are present in the Middle Fork Willamette subbasin.



Hills Creek Fall/Winter Downstream Fish Passage (Injunction Measure 8/Interim Measure 20)

Description: Injunction Measure 8 requires the Corps to continue carrying out a fish passage operation at Hills Creek Dam detailed in the Corps' Interim Measure No. 20. On October 6, 2021, the Corps and NMFS notified the Court of a modification to Interim Measure 20 to correct an error in the original description. This downstream fish passage measure includes prioritizing the regulating outlets at Hills Creek Dam during the night between 6:00 PM and 10:00 PM once the reservoir is 50 feet or less above the regulating outlet intakes (approximately elevation 1460 ft. or less). It is anticipated this measure will be implemented from mid-November/early December through March 1, depending on water conditions and resultant forebay elevations.

Implementation: On October 28,2021, Hills Creek Reservoir was drawn down to El. 1460 ft., marking the start of RO operations to pass fish through a non-turbine outlet at night (with generation during the day) for improved downstream fish passage and survival (Figure 31, red dotted line). During the implementation of this measure, there were two nights when flow releases were not shifted from the powerhouse to the ROs (November 2, 2021 and December 10, 2021). These were due to operational oversight during shift changes between operators. Corrections to protocols and processes have been employed to eliminate these operational errors in the future.

The Hills Creek nighttime RO operation will continue until spring when the reservoir is refilled back above El. 1460 ft., at which point, dam outflows will transition back to turbine releases.

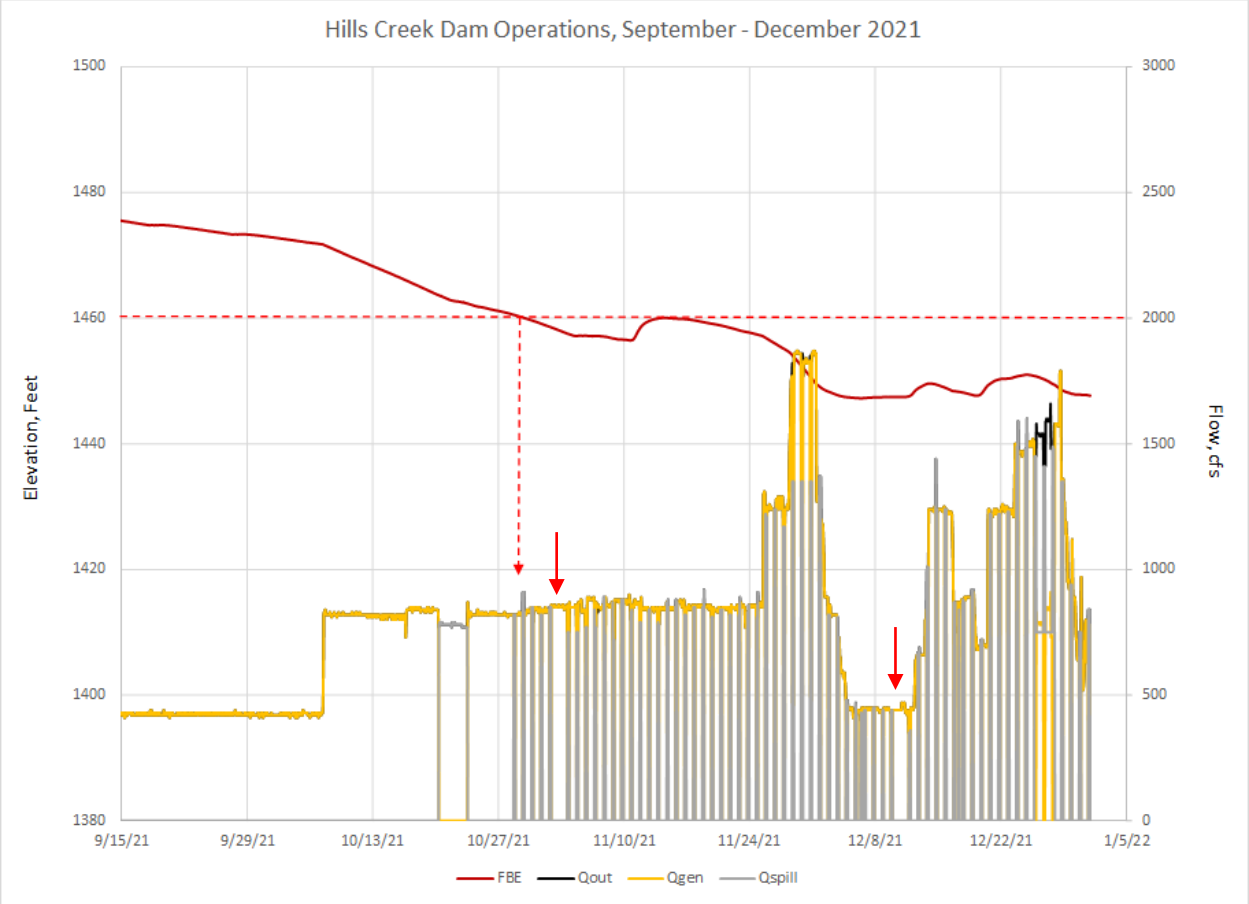
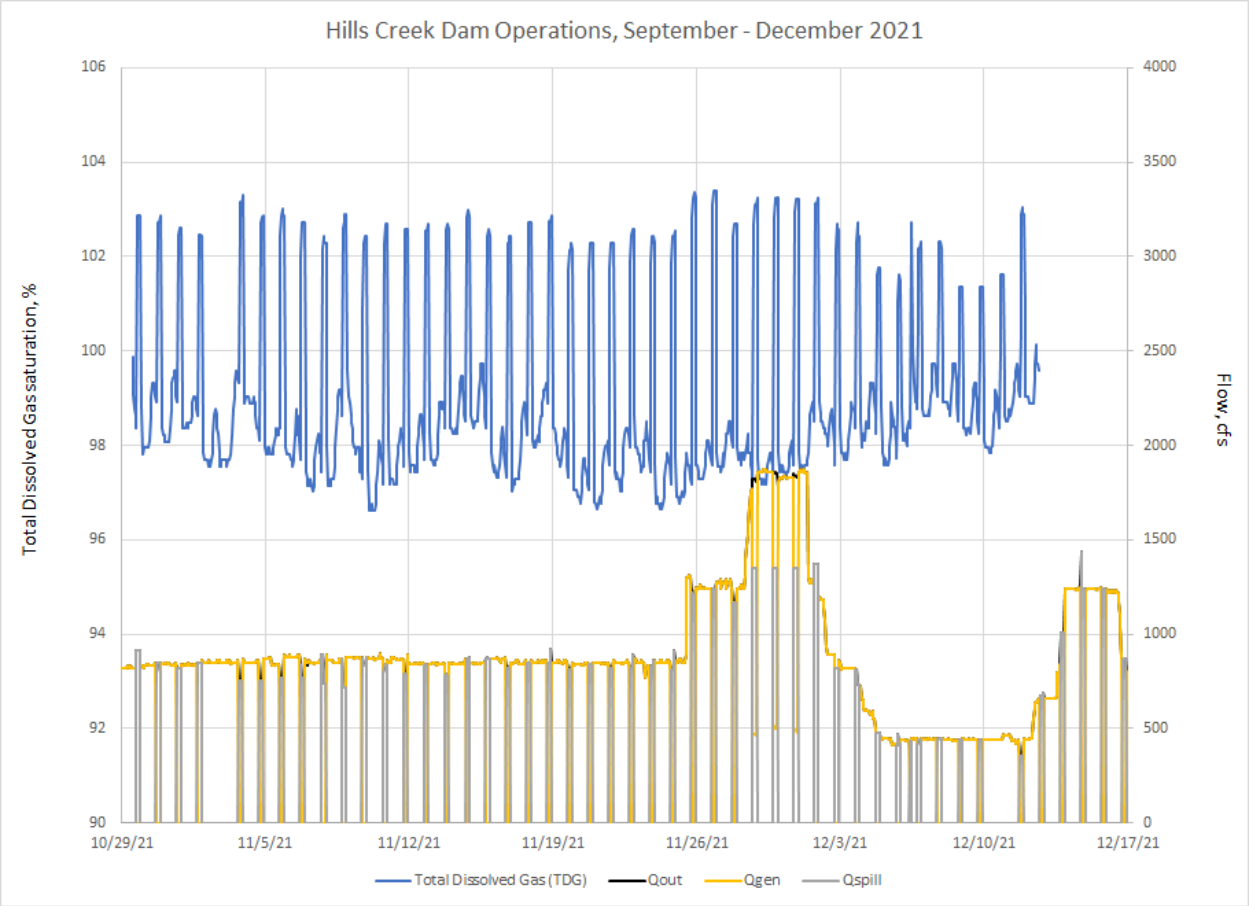


Figure 31. Hills Creek Dam Operations, September - December 2021

RM&E: During the Hills Creek nighttime RO operation, a hydrolab was deployed downstream of Hills Creek Dam to monitor TDG (Figure 32). As shown in the figure below, TDG remained well below the State water quality standard of 110% throughout this operation.



In 2022, the Corps will fund the USGS to install and maintain a real-time TDG gauge downstream of Hills Creek Dam, which will provide immediate information and help to manage RO operations. This information will be available on both the Corps' dataquery website (https://www.nwd-wc.usace.army.mil/dd/common/dataquery/www/) as well as the USGS NWIS site (https://waterdata.usgs.gov/nwis).

Starting October 21, 2021, the Corps began operating rotary screw traps in the Hills Creek Dam tailrace (Figure 33 and Figure 34). To monitor the operation of the regulating outlet, a single 5 ft rotary screw trap was placed just downstream of regulating outlet spillway. Due to the regulating outlet rotary screw trap sampling location being downstream of the confluence with the powerhouse discharge channel, an 8 ft rotary screw trap was placed in the powerhouse channel as well in order to distinguish between the two potential routes of passage.

Rotary screw trap sampling captured fish throughout the period of October 21, 2021 to January 15, 2022 with consistent limited numbers of juvenile Chinook being caught (Table 6). Of note, no adult spring Chinook were outplanted above Hills Creek in calendar year 2021 due to low returns of adults to the Middle Fork Willamette River. While 100,000 juvenile hatchery spring Chinook are typically released annually above Hills Creek Dam, fish were not outplanted above Hills Creek Dam in 2021 due to the low adult returns in 2020 and prioritization of hatchery juvenile Chinook releases in the

Middle Fork Willamette River below Hills Creek Dam. For additional information, see 21DEX02 MFR Middle Fork Willamette Adult Chinook Outplanting - W9127N19C0030, Middle Fork Willamette Adult Chinook Outplanting and Juvenile Fingerling Release(s) (http://pweb.crohms.org/tmt/documents/FPOM/2010/Willamette_Coordination/2021_WFPOM/2021_SEP/).

Figure 33 - Hills Creek Dam tailrace rotary screw trap sampling locations. A 5-foot diameter rotary screw trap was placed below the Regulating Outlet (RO) and an 8-foot rotary screw trap was placed below the Powerhouse (PH). A rotary screw trap was not explicitly placed/sampled below the spillway gates as the Hills Creek Dam spillway gates are only used in emergency situations and did not operate during this period.

Figure 34. Hills Creek Dam – 5 foot diameter rotary screw trap below regulating outlet. Photo taken 04 September 2021 midday while powerhouse (PH) is in operation with no flow through regulating outlet (RO).

Table 6. Descriptive statistics of Chinook (CHS) captured at Hills Creek Dam from 21 October 2021 to 15 January 2022 for the Regulating Outlet (RO) and Powerhouse (PWR). The RO trap catches from both the PWR and RO routes. Please note that data contained herein is subject to revision as this data is preliminary and undergoing QA/QC procedures.

Site	Route	Species	Life stage	Collected	Length (mm)*			Weight (g)*		
					Min	Max	Mean	Min	Max	Mean
Hills Creek	RO	CHS	Parr	6	90.0	141.0	110.7	7.4	23.4	13.3
		CHS	Smolt	55	137.0	265.0	232.2	27.4	192.3	144.4
Hills Creek	PWR	CHS	Parr	0	n/a	n/a	n/a	n/a	n/a	n/a
		CHS	Smolt	22	144.0	265.0	230.0	34.6	202.2	138.9

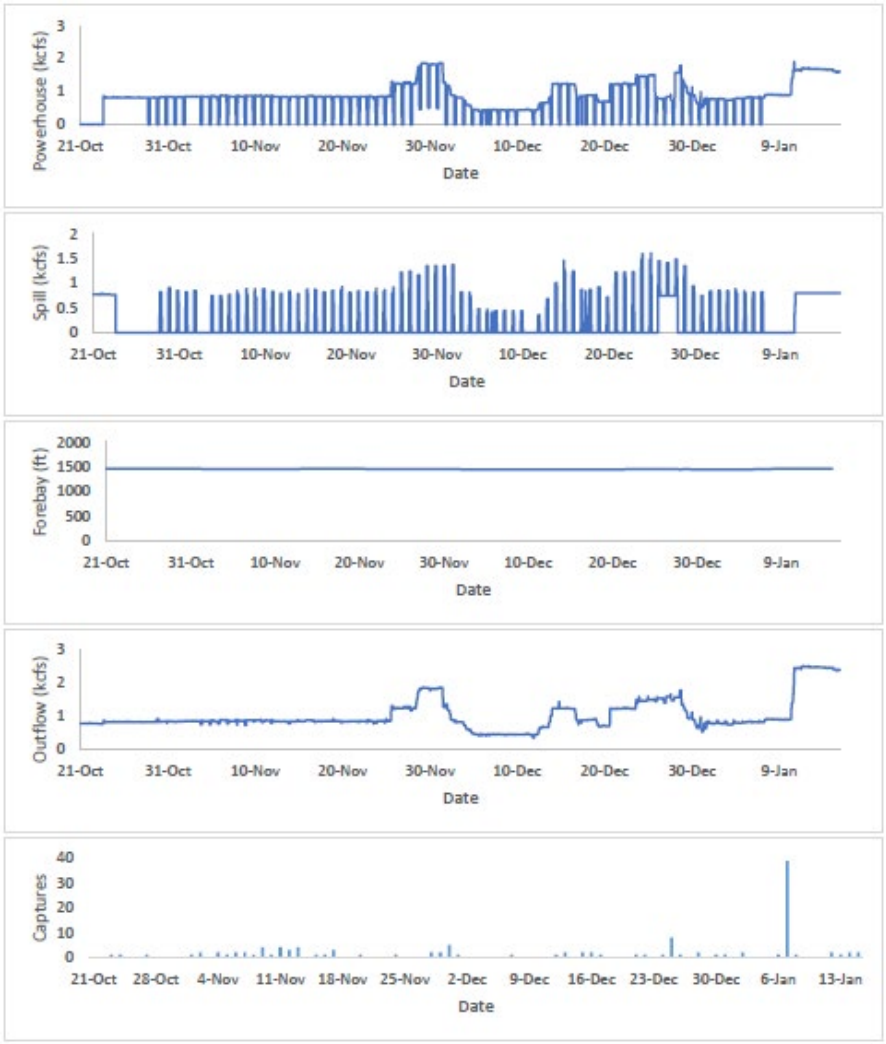


Figure 35. Hills Creek Operational and juvenile Chinook capture data from 21 October 2021 to 15 January 2022. Spill represents flows through the Regulating Outlet (RO); the spillway gates at Hills Creek dam are used only for emergencies and were not operated during this period. Captures represent total juvenile Chinook captured through both the RO and Powerhouse routes. These results represent direct capture of juvenile spring Chinook and have not been adjusted for rotary screw trap capture efficiency or sampling effort. Please note that data contained herein is subject to revision as the data is preliminary and undergoing QA/QC procedures.

Lessons Learned/Future Year Recommendations: Overall, the Hills Creek fall/winter downstream fish passage operation was implemented without problem and no modification to this operation is suggested for next year.

Lookout Point Deep Drawdown for Downstream Fish Passage (Injunction Measure 16)

Description: The Corps completed an assessment to determine the degree of landslide risk associated with implementing a fall deep drawdown at Lookout Point Reservoir and recommended

that the deep drawdown operation not proceed unless certain landslide risk mitigation measures are in place prior to commencing the drawdown.

Implementation: This operation has yet to be implemented.

RM&E: The Corps has three 8 ft. diameter rotary screw traps deployed below Lookout Point Dam ready to sample beginning mid-March 2022 (Figure 36). These rotary screw traps will be operated through the term of the injunction based on requirements identified in the Willamette Project Interim Injunction Measures RM&E Plan. Additional RM&E planned for Lookout Point can also be found this plan.

Dam Safety Monitoring: A landslide assessment of the reservoir rim area was conducted, and recommended monitoring be performed along portions of the reservoir during implementation of this operation.

Lessons Learned/Future Year Recommendations: TBD

Lookout Point/Dexter Spring Downstream Fish Passage and Regulating Outlet Use for Downstream Water Temperature Management (Injunction Measure 17)

Description: This measure is to provide improved downstream fish passage past Lookout Point in the spring, combined with improved downstream water temperatures through the use of regulating outlet discharges in the summer.

Implementation: The spring spill operation will begin in March 2022 by using storage from Hills Creek Reservoir, if necessary, to refill Lookout Point Reservoir according to rule curve. Once the reservoir reaches 2.5 feet over spillway crest (elevation 890 ft.), the Corps will start continuous, ungated spill to maintain the reservoir level between elevation 890-893 ft. for as long as water conditions allow.

RM&E: The Corps is preparing to deploy a rotary screw trap above Lookout Point Dam reservoir and below the confluence with the North Fork Middle Fork Willamette River (Figure 37). This rotary screw trap is anticipated to monitor juvenile Chinook entry into the Lookout Point Reservoir for the mid-March to mid-December 2022 period.

The Corps is preparing to deploy a rotary screw trap in the Dexter Dam tailrace for the mid-March to mid-December 2022 period. This rotary screw trap, in conjunction with three rotary screwtraps in the Lookout Point Dam tailrace, will monitor juvenile Chinook passage timing through the Lookout Point Dam and Dexter Dam complex for the mid-March to mid-December 2022 period.

Additional RM&E planned for Lookout Point will be found in the Willamette Project Interim Injunction Measures RM&E Plan.

Figure 36. Lookout Point Dam (upstream dam on right side of image) and Dexter Dam (downstream dam on left side of image). Three 8-foot diameter (2.4 m) rotary screw traps are currently deployed in the Lookout Point Dam tailrace (circled in red).

Figure 37. Anticipated rotary screw trap deployment location above Lookout Point Dam and below the confluence with the North Fork Middle Fork Willamette River.

Dam Safety Monitoring: TBD

Lessons Learned/Future Year Recommendations: TBD

Fall Creek Extended Winter Drawdown for Downstream Fish Passage (Injunction Measure 19)

Description: Injunction Measure 19 requires the Corps to conduct the annual deep drawdown of Fall Creek Reservoir similar to prior years (typically 5-7 days) but extends the dates from December 1 through January 15. Starting on December 01, Fall Creek Reservoir will be drawn down to El. 685-690 ft. and the RO (located at the base of the dam, at the elevation of the riverbed) will be used to pass fish downstream of Fall Creek Dam.

Implementation: While the injunction requires the Corps to carry out an annual extended deep drawdown and fish passage operations at Fall Creek Dam from December 1 through January 15, 2021, the Corps implemented an earlier drawdown in fall 2021 that was more aligned with the rule curve and typical drawdown rate and timing of Fall Creek Reservoir. Real-time screwtrapping data indicated fish were beginning to move from the reservoir in early November 2021. Therefore, to prevent injury or delay in fish exiting the reservoir, the Corps conducted a drawdown on November 05. During this first drawdown, Fall Creek Reservoir was limited to a drawdown of ~ El. 690 ft. This elevation was chosen based on past RM&E data indicating that the screwtrap downstream of Fall Creek Dam can still be fished at this elevation. In other words, limiting the Fall Creek Reservoir drawdown to El. 690 ft. meant that the Corps could continue to collect biological information through screwtrapping without sediment impacting its functionality.

The first drawdown was held for less than a week, and the reservoir was then allowed to rise again, which coincided with a large rain event on November 11, 2021. The reservoir was then gradually drawn back down for the second drawdown required by the injunction. The targeted drawdown elevation of 680 feet was reached on December 01, 2021 (Figure 38). On January 16, 2022, the reservoir began to be refilled to elevation 700 ft, where it will be held until March 15 as required by the implementation plan for Injunction Measure 20.

During the second drawdown, a significant amount of sediment was released from the reservoir as discussed in the RM&E section below.

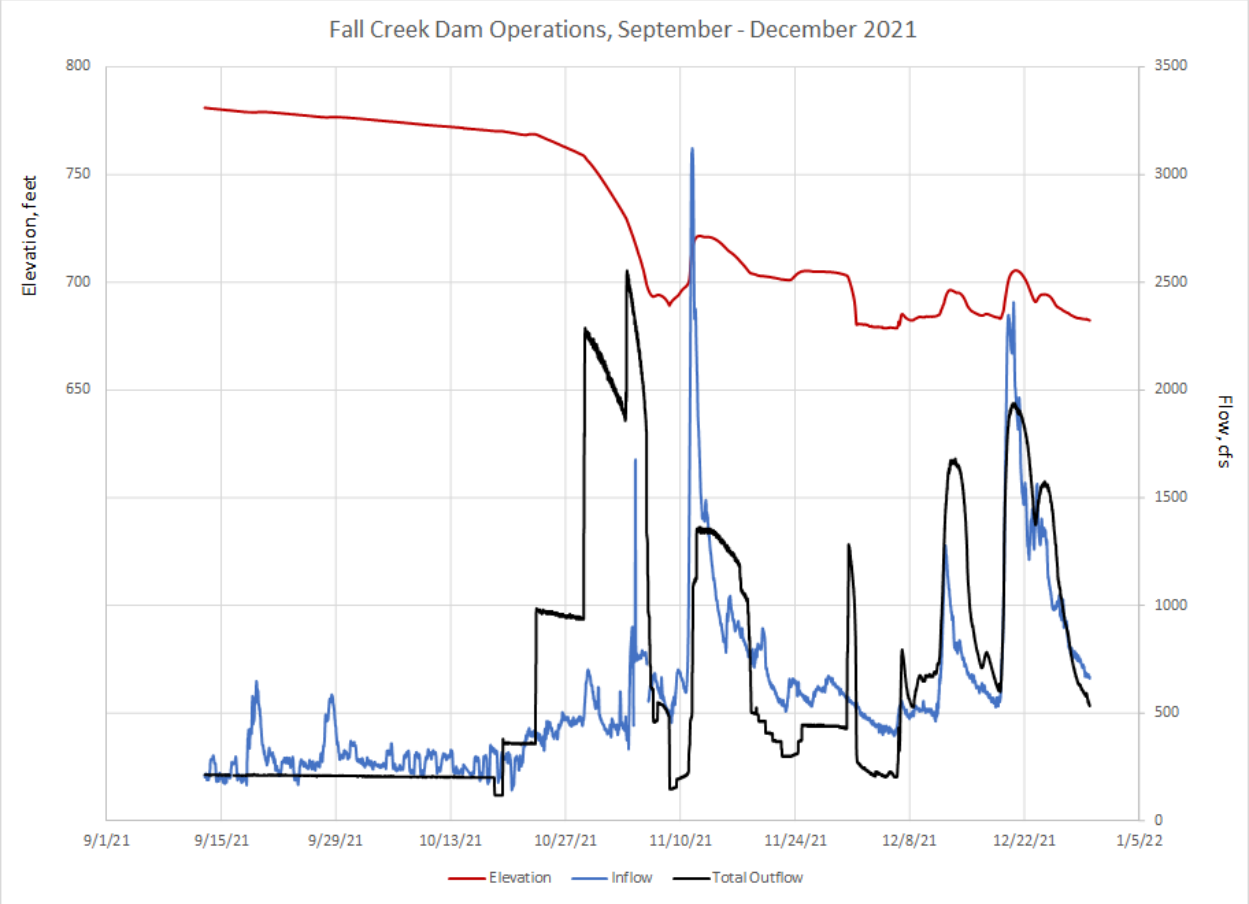


Figure 38. Fall Creek Dam and Reservoir Operations, September - December 2021

RM&E: The Corps funded the USGS to monitor turbidity and dissolved oxygen (DO) downstream of Fall Creek Reservoir during the deep drawdown of Fall Creek Reservoir. This information is shown in Figure 39, below. As shown, throughout the operation, elevated turbidity was observed anytime the reservoir was below El. 700 ft. following high outflow. Sediment releases first peaked on December 4 after already high sediment concentrations. Turbidity then settled down while discharges were low, peaking again each time discharges were increased during storm events.

DO responded with a slow and steady decrease, implying the reservoir pool was continuously accessing reduced sediment (or porewater) early on in the drawdown operation. On December 6, 2021, DO dropped below 2 mg/L and eventually to 0 mg/L. This anoxia lasted for about 6 hours before DO increased back to saturation. The DO drop coincided with a large increase in flows in response to the first storm event that occurred while Fall Creek was in its drawn down state. This event was short-lived, and the amount of fresh saturated water was possibly not large enough amounts to override the anoxic sediment and porewater that was liberated downstream. During the second and third high flow events, DO was not reduced, suggesting that the sediment released from the reservoir during these events was overridden by fresh saturated water and/or sediment that was not in a reduced state.

The relationship between sediment releases and DO sags is complex and while data has been collected now for years below Fall Creek Dam, the response from the deep drawdown of Fall Creek continues to vary from year to year. Turbidity and DO monitoring should continue during future deep drawdowns of Fall Creek Reservoir so that additional information can be learned from this operation.

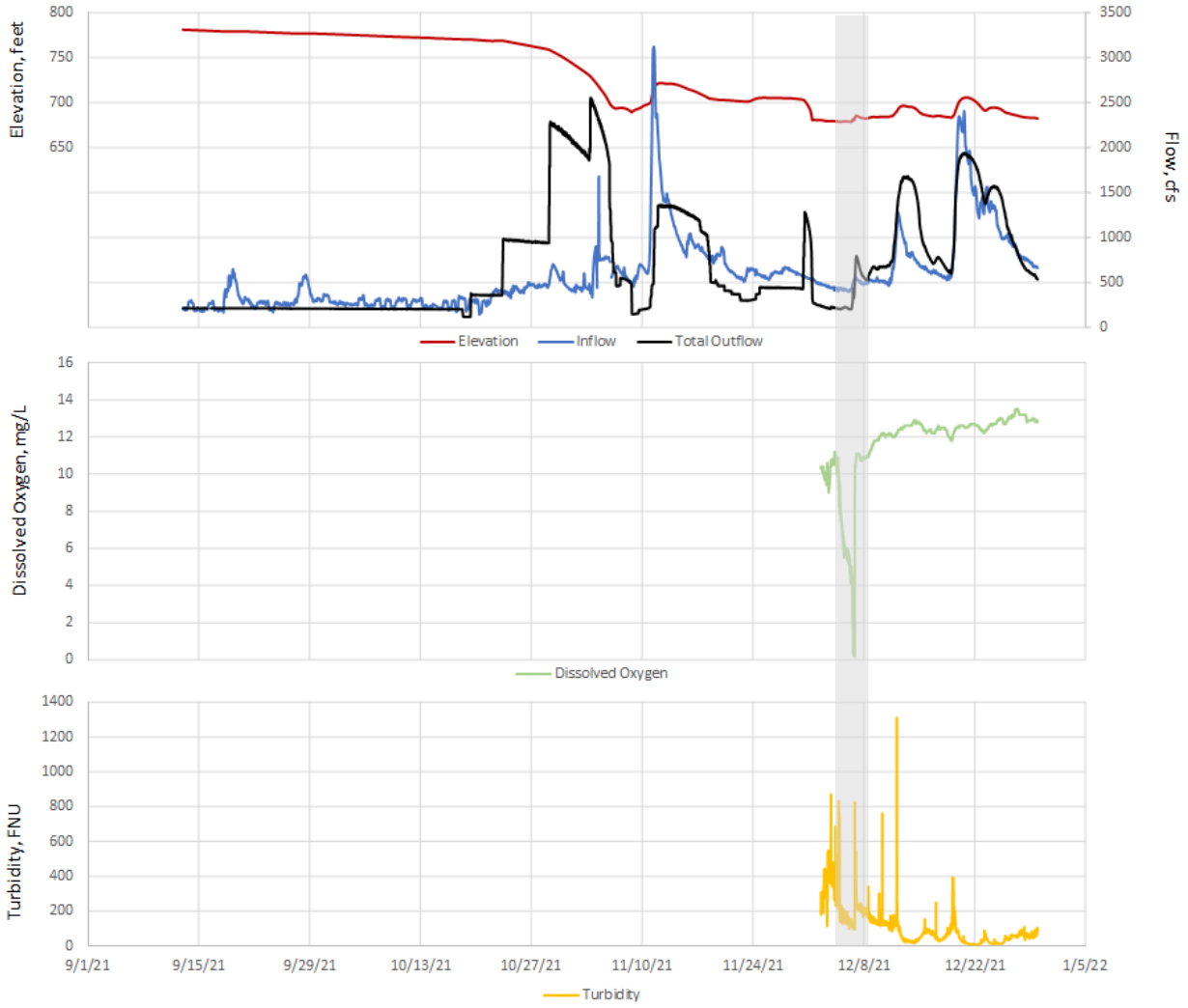


Figure 39. Fall Creek Dam and Reservoir Operations and Resultant Downstream Turbidity and Dissolved Oxygen

Starting October 19, 2021, the Corps began operating an 8 ft rotary screw trap in the regulating outlet channel below Fall Creek Dam (Figure 40).

Figure 40. Fall Creek rotary screw trap sampling location

The trap captured the first Chinook on October 25, 2021. A total of 646 Chinook were captured from October 25 - November 7, 2021 (Table 7). After the initial drawdown to elevation 690 no Chinook were observed during the refill after November 8 or during the drawdown beginning on November 30, 2021. On December 1, the reservoir elevation reached streambed and the screw trap was inoperable due to high sediment loads released from the dam. The Corps placed the screw trap back in service on 20 Jan 2022. A total of three Chinook were captured through 31 Jan 2022. The mean length of Chinook captured was 187 mm and ranged from 104 to 270 mm.

Table 7. Fall Creek Trap Capture Information, mid-October - December 2021.

Sampling Period	Species	Life Stage	# Collected	Length (mm)	Mean Weight (g)
Oct19 -Nov 7	CHS		646	187	na
Nov 8-Nov 30	CHS		0		
Dec 1-Jan 15	Screw Trap did not operate due to sediment load				
Jan 20-Jan 31	CHS		3		

Dam Safety Monitoring: Additional visual monitoring and inspection was performed during the initial deep drawdown. Compared to previous drawdown inspections, additional erosion adjacent to the RO intake training walls was observed. Continued monitoring is recommended for future operations.

Lessons Learned/Future Year Recommendations: The Corps will continue to time the initial drawdown of Fall Creek Reservoir to align with the movement of fish from the reservoir, so as to prevent any injury or delay in exiting the reservoir. This outmigration timing is linked to reservoir elevation and typically occurs as Fall Creek Reservoir elevations fall below El. 728 ft., typically in early November. As required by Injunction Measure 19, a second drawdown will continue to be implemented as well. While the biological merits of the second, extended drawdown are unknown, this measure was implemented without problem in 2021, and no modifications to this operation are suggested for next year.

Fall Creek Spring Downstream Fish Passage (Injunction Measure 20)

Description: The Expert Panel submitted an implementation plan for a delayed refill of Fall Creek Reservoir on October 15, 2021, which the Court adopted in an order dated November 2, 2021. This measure requires the Corps to carry out a delayed refill of Fall Creek Dam combined with the prioritized use of the regulating outlets from January 16 – May 15.

Implementation: On January 16, 2022, the Corps began refilling Fall Creek Reservoir to El. 700 ft. This elevation, combined with prioritized use of the regulating outlets, will be carried out from January 16 – March 15. This will ensure that a screw trap can be deployed downstream of Fall Creek Dam for continuous biological monitoring throughout the winter/spring operation. On March 16, refill will resume with a goal of reaching El. 728 ft. by April 15. This elevation, combined with prioritized use of the regulating outlets, will be carried out until May 15. On May 16, Fall Creek Reservoir will be refilled to the highest elevation possible so that the fish horns can be used to provide sufficient discharge to operate the adult trap through September 30. The ability to operate the various fish horns also provides downstream water temperature management. This can be very important during the summer and fall months. The fish horns do not provide an efficient juvenile passage route.

RM&E: Starting 13 January 2022, the Corps began operating an 8 ft. diameter rotary screw trap above Fall Creek Dam reservoir just downstream of the US Forest Service Dolly Varden Campground (Figure 41, Figure 42). This rotary screw trap will be operated for the 2022 spring outmigration period (January-May 2022) and in future years as necessary to meet annual monitoring requirements. As of 15 January 2022, no juvenile Chinook had been caught in the rotary screw trap.

Additional RM&E planned for Lookout Point will be found in the Willamette Project Interim Injunction Measures RM&E Plan.

Figure 41. Fall Creek Rotary Screw Trap deployment location above Fall Creek Dam. Sampling site is just downstream of the US Forest Service Dolly Varden Campground.

Figure 42. Rotary screw trap sampling above Fall Creek Reservoir in 2021. Location for 2022 sampling is at the same location just downstream of the US Forest Service Dolly Varden Campground.

Lessons Learned/Future Year Recommendations: TBD

Willamette Fish Operations Plan Deviations (unit outages, ramp rates, minimum flows)

Injunction Measure 5 requires the Corps to follow its established maintenance outage schedules and emergency protocols, and Injunction Measure 6 requires that the Corps include information on any deviation from outage schedules in these biannual status reports.

In accordance with Reasonable and Prudent Alternative Action 4.3 set forth NMFS's 2008 BiOp for the Willamette Valley Project (WVP), the Corps annually develops the Willamette Fish Operations Plan (WFOP) in coordination with the Willamette Fish Passage Operations and Maintenance (WFPOM) team (comprised of the Corps, Bonneville Power Administration, NMFS, U.S. Fish and Wildlife Service, Oregon Department of Fish and Wildlife, and other regional federal, state, and tribal agencies). The WFOP describes year-round operations and maintenance activities at WVP

dams to protect and enhance anadromous and resident fish species listed as endangered or threatened under the ESA, as well as non-listed species of concern. The WFOP guides Corps actions related to fish protection and passage at the WVP dams. Among other items, the WFOP sets forth outage periods for the WVP dams during which any turbine unit outages necessary for maintenance should be scheduled. The WFOP also sets forth processes for coordinating revisions to the WFOP, both annually and throughout the year, and deviations from WFOP criteria, including notification and reporting protocols for unplanned and emergency deviations. The published WFOP is available at https://pweb.crohms.org/tmt/documents/FPOM/2010/Willamette_Coordination/WFOP/.

During the period covered by this status report, there were two unplanned outages that occurred that deviated from the outage periods specified in the WFOP.

(1) An outage from October 18-21, 2021, occurred at Cougar Dam where two units went offline during the WFOP outage window when only one unit is allowed to be out of service. This was due to Bonneville Power Administration-led structural maintenance activities. This conflicted with the WFOP, however, current Injunction Measure 14 required units to be offline regardless unless higher outflows were required. Since the WFOP outage window requirements and Injunction Measure 14 are in conflict, Injunction Measure 14 was determined to be the governing requirement.

(2) An outage occurred with unit two at Cougar Dam on 31 December 2021 for approximately three hours during the restricted time period specified in the WFOP that requires both units remain online. This was caused by an issue with a relay (electrically operated switch).

Other deviations from the WFOP during the period covered by this status report are listed below in Table 8.

Table 8. Reportable Exceedances from criteria listed in the 2008 Biological Opinion issued by the National Marine Fisheries Service (NMFS)

Project	Exceedance	Date	BiOp Criteria/Exceedance Value
Foster Dam	ramp rate	06 Oct 2021	-0.2 ft/hr/-0.39 ft/hr
Hills Creek Dam	minimum flow	05 Dec 2021	400 cfs/347 cfs
Dexter Dam	ramp rate	07 Dec 2021	-0.2 ft/hr/-0.42 ft/hr
Blue River Dam	ramp rate	14 Dec 2021	-0.2 ft/hr /-0.48 ft/hr

Structural Measures

Dexter Adult Fish Facility

Design work is ongoing for upgrades to the Dexter Adult Fish Facility (AFF). Corps and NMFS staff are coordinating to ensure that the upgraded facility meets NMFS criteria. Most of the models and drawings from the previously-"shelved" design have been refreshed. It has been determined that

construction of the new fish ladder entrance section while maintaining the existing water supply line during construction is not feasible because it poses too many risks to human safety and infrastructure. Therefore, a temporary pump station is planned to be added to maintain water supply to the existing facility during construction of the upgrades. The review and approval processes for completion of engineering and design have been identified and started where appropriate, as have environmental compliance activities. Cost estimates continue to be refined and improved, and optimal construction sequencing has been finalized to minimize supply chain disruptions while maximizing the use of the available physical footprint of the site. At this time, the team has identified critical path elements for the schedule and is working to develop a feasible schedule for completion of design and construction, which is likely to extend beyond the September 1, 2023 deadline set forth in the injunction due to the complexity and scale of the upgrades. Once a feasible schedule is finalized, the Corps and NMFS will seek to have the deadline extended accordingly.

Big Cliff TDG Abatement Modifications

On February 10, 2022, the Expert Panel submitted a recommendation to the court to move forward with structural TDG abatement in the North Santiam River. The Corps intends to establish an engineering design team to evaluate the TDG issue in the North Santiam River and develop a reasonable timeline for designing and constructing a structural solution for mitigating excess TDG levels below Big Cliff Dam during spill operations. The Corps will submit the timeline for design and construction to the Court by no later than August 5, 2022.

Cougar Regulating Outlet Modifications

An Expert Panel recommendation on whether Cougar Dam RO structural improvements/modifications are needed for safer fish passage and reduce TDG levels is due to the Court on March 15, 2022.

Lebanon Dam PIT Detection Arrays (Antennas)

A Corps design team has been established to plan and install PIT detection arrays (PIT antennas) at Lebanon Dam as required by the implementation plan ordered by the Court for the Foster fall downstream fish passage operation (Injunction Measure 13a). On August 25, 2021, the Corps initiated discussions with the City of Albany Public Works Division (owner of Lebanon Dam) for approval to install and maintain the PIT antennas on the dam. On September 28, 2021, the City of Albany approved, in principle, the Corps' request to install and maintain the PIT antennas on the dam. The Corps Real Estate Office is working with the City of Albany on the real estate agreement. Additionally, the Corps will have to complete an environmental assessment pursuant to the National Environmental Policy Act (NEPA), National Historic Preservation Act (NHPA) Section 106 consultation, and other environmental compliance requirements prior to installation. The Corps is

working to have the PIT antennas installed and operational by fall of 2022, barring any supply chain delays for the parts and materials for construction of the PIT antennas.